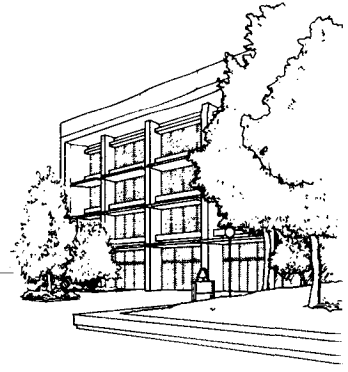
CITY OF FAIRFIELD

Incorporated December 12, 1903

1000 WEBSTER STREET
FAIRFIELD, CA 94533-4883
[707] 428-7485



01697

JUN 0 9 1998

May 29, 1998

CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, California 95814
ATTN: Rick Breitenbach

SUBJ: Draft Programmatic EIS/EIR Comments

Dear Sir/Madam:

The City of Fairfield previously commented that the CALFED Bay-Delta Program solution should not diminish raw water quality at the intake to the North Bay Aqueduct (see attached scoping comments letter dated May 21, 1996). Recent and ongoing events now cause us to insist that the CALFED Bay-Delta Program include a component to *enhance* NBA raw water quality.

Our city operates the North Bay Regional Water Treatment Plant, a relatively new (1990) 40 mgd facility we own with the City of Vacaville pursuant to a joint powers agreement. The plant serves drinking water to about 100,000 people in the two cities.

The plant is well designed, maintained, and operated. Yet we have now found there are times when we cannot treat water from the NBA to meet our finished water quality goals.

This is not a major problem at present because we have the ability to take raw water into the plant from another source, the Solano Project, via the Putah South Canal (PSC). But as the two cities continue to grow, we will not have the luxury of simply going off the NBA supply. Other agencies on the NBA have even less

flexibility (e.g., Travis Air Force Base, City of Benicia, and City of American Canyon), and they must accept whatever raw water quality is in the NBA now.

The attached Chart 1 graphically illustrates our water quality problem. Total organic carbon (TOC) concentration in NBA water is commonly two to four times the level in PSC water. Concentrations of over 20 mg/l are not uncommon. NBA TOC concentrations are also far higher than the TOC levels found at the south Delta export pumps. To make matters worse, water quality in the NBA can show dramatic swings, making it even more difficult to treat reliably. These problems are well documented in monitoring and sanitary surveys conducted by the California Department of Water Resources and the State Water Project contractors, as well as by our own staff.

This year, for the first time, we measured unacceptable levels of trihalomethanes (THMs) in our finished water when attempting to treat NBA water, as illustrated in the attached Chart 2. (THMs continue to form in the distribution system, so a THM level at the plant of 30 μg/l, or even less, can easily exceed 100 μg/l at a customer's tap.) We believe the high raw water TOC in conjunction with trace amounts of bromide caused this problem, which has forced us to abandon the NBA supply at least partly since mid-March and totally since late April.

Although we use two stages of ozone in our plant for primary disinfection, we chlorinate for the residual disinfectant. Converting to monochloramine as our residual disinfectant is planned and would help control THM formation, but THMs are only one aspect of a greater problem. With increasingly stringent drinking water treatment standards coming, we must also be concerned, for example, about meeting basic turbidity removal reliability (which is adversely affected by TOC), controlling bacteria regrowth in our distribution system due to high assimilable dissolved organic carbon in the finished water, and being prepared to treat for as yet unregulated disinfection byproducts. All of these goals are best addressed by improving raw water quality, particularly reducing the concentration and variability of TOC. These are the same concerns voiced by the south Delta exporters, but our TOC problems are even more severe.

We believe solutions for TOC control in our raw water supply may take two basic forms; either a new intake for the NBA (or replacing the NBA altogether) or a

major watershed management program to improve water quality at the existing intake. CALFED has recognized the latter approach as a common Program element, and we agree that initial efforts should focus on that approach. But for a long-term solution, we believe the former approach may be necessary, and it should be considered among the conveyance alternatives.

In this regard, we submit a copy of a reconnaissance-level investigation we and other agencies in Solano and Yolo counties performed in 1992. The investigation studied several alternative points of diversion north of the Delta.

You may note that in the 1992 investigation, we did not contemplate extending a new conveyance facility all the way to the municipal water treatment plants in Solano County. Instead, we planned to exchange water with Solano Irrigation District in the northern part of the county for additional Solano Project supplies. Similarly, and more recently, we have considered delivering Delta water to the Maine Prairie Water District from a new Delta diversion point in exchange for Solano Project water.

The main impediments to these projects are only partly financial. The projects are more often impeded by institutional and political constraints that we believe the CALFED Bay-Delta Program is well designed to overcome. However, as of yet, the CALFED Bay-Delta Program has not adequately addressed our concerns. Certainly if the south Delta exporters get an isolated facility or improved delta flow-through to improve raw water quality, we should get similar considerations in the NBA service area.

As implied above, our particular need is not immediate, so we do not require assurances of a complete solution in the first phases of implementation. Watershed management programs may prove to be an effective solution, and they should proceed as soon as possible and be evaluated. If watershed management alone does not work, however, the CALFED Bay-Delta Program should provide other options in subsequent phases.

As an urban agency, it is likely we have the ability to pay for our fair share of a solution that may involve a relocated NBA intake or new conveyance. What we need now is simply for our concerns to be addressed seriously as part of the consensus solution for the Bay-Delta.

C-015634

Please contact us if you require more information.

Very truly yours,

Ronald L. Hurlbut
Director of Public Works

cc: Dale Pfeiffer, City of Vacaville
Ex Ganding, City of Vallejo
Virgil Mustain, City of Benicia
Bob Isaac, Solano Irrigation District
Ed Coffelt, Maine Prairie Water District
David Okita, Solano County Water Agency
Rick Woodard, CALFED Bay-Delta Program

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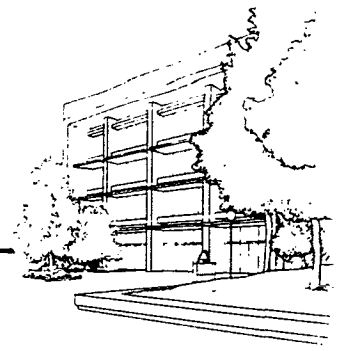
C-015635



CITY OF FAIRFIELD

Incorporated December 12, 1903

1000 WEBSTER STREET
FAIRFIELD, CA 94533-4883
[707] 428-7485

May 21, 1996

CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, California 95814

SUBJ: Scoping Comments

Dear Sir/Madam:

The City of Fairfield urges the EIR/EIS for the alternative CALFED Bay-Delta solutions to consider water quality impacts on water delivered through the North Bay Aqueduct (NBA).

The NBA is the only State Water Project diversion from the north delta. Due to its relatively small size (175 cfs) compared to other State Water Project delta diversions, the NBA diversion is often overlooked, but the NBA is a major source of water for the urban areas of Solano and Napa counties and serves over 350,000 people.

The recent update to the State Water Project sanitary survey showed the NBA water supply to have the highest trihalomethane formation potential of all State Project diversions. Other water quality conditions make NBA water the most challenging to treat in the entire State Project system.

Although Fairfield and other public agencies in the NBA service area have added or upgraded treatment plants to use NBA water safely, we are justifiably concerned about any Bay-Delta solution that would reduce NBA water quality further without adequate mitigation or offsetting benefits.

Very truly yours,

Ronald L. Hurlbut
Director of Public Works

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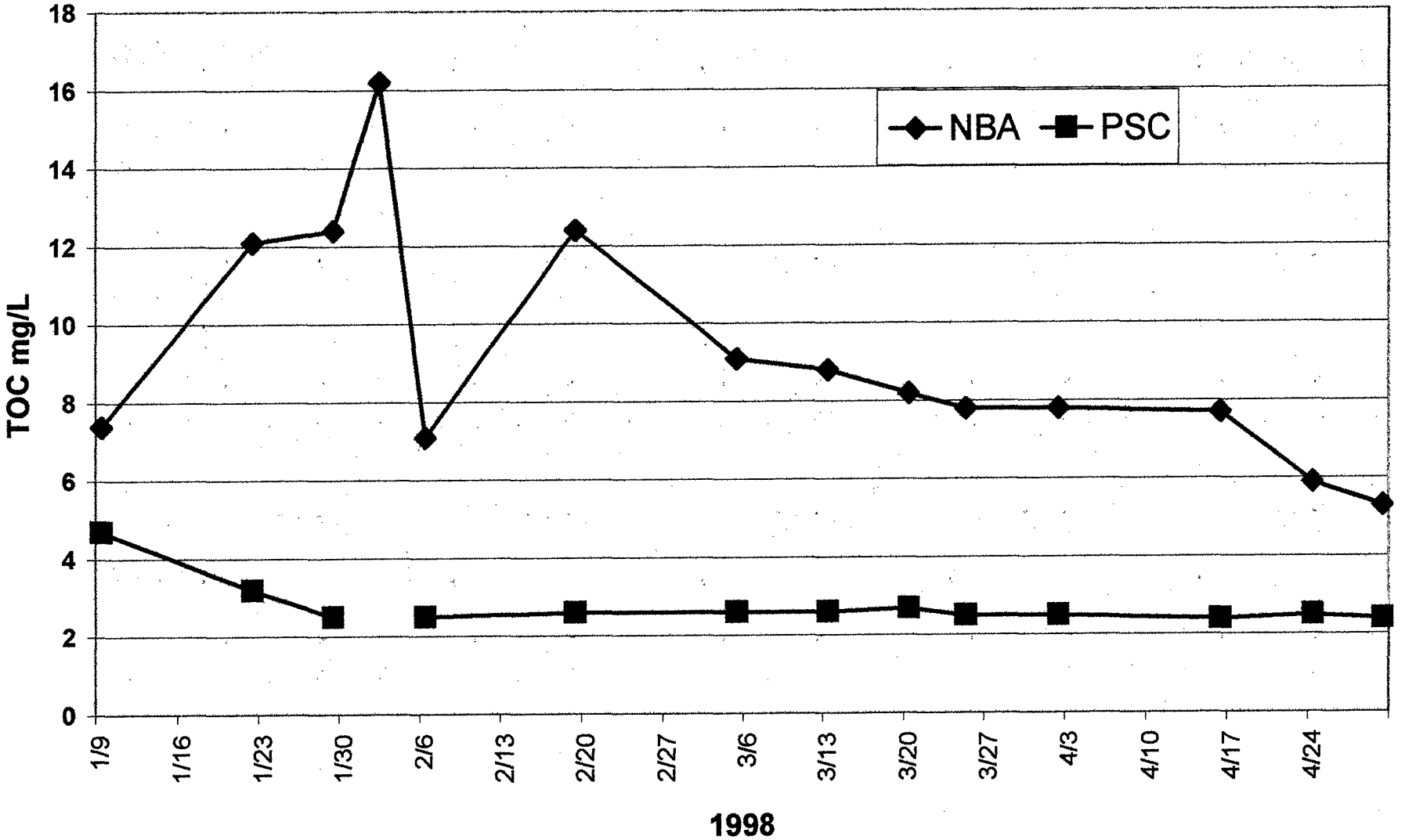
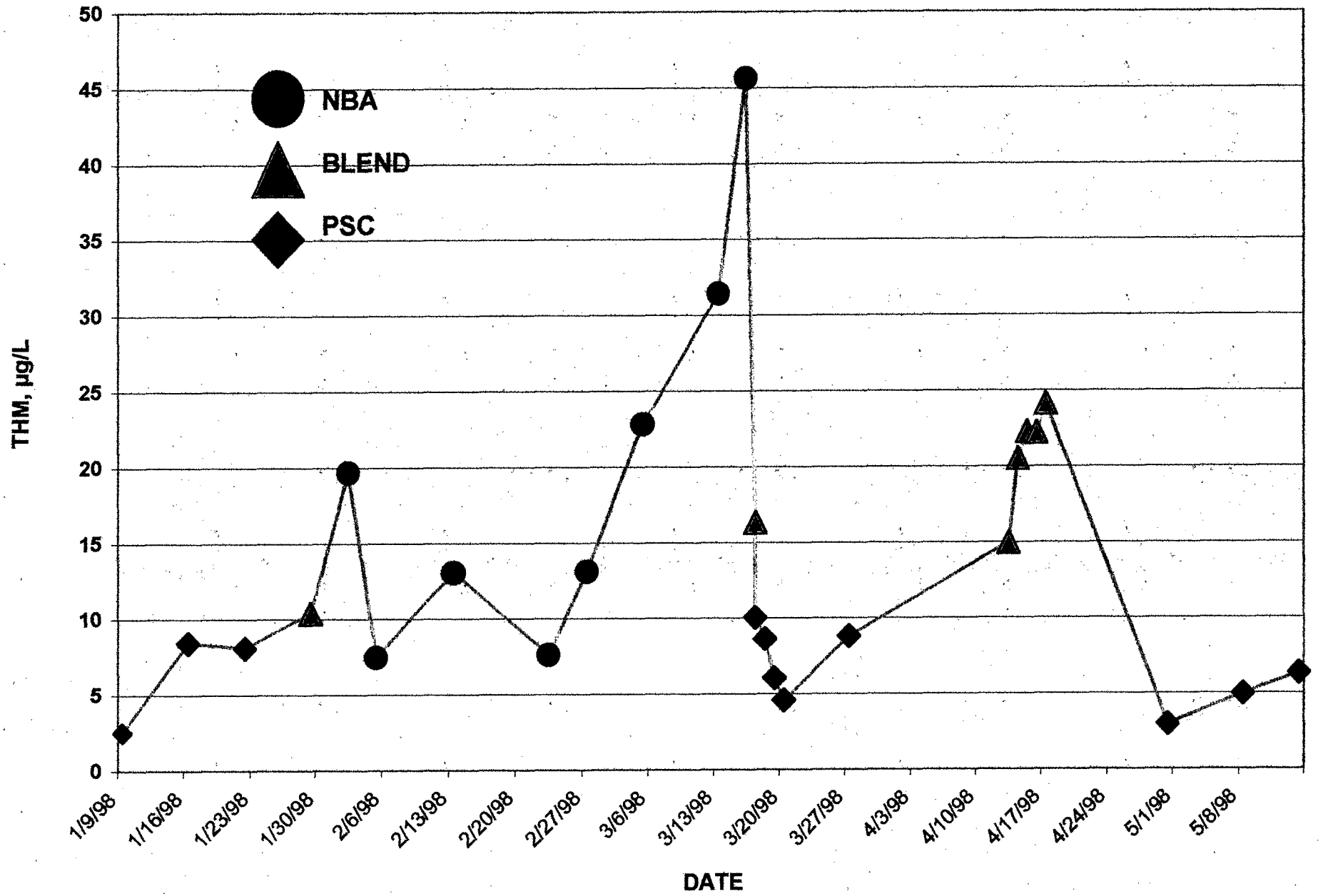
C-015636

NBRWTP SOURCE WATER TOC, mg/L



NBRWTP TREATED WATER TOTAL THMs



NBRWTP WQ Laboratory Data

5/27/98

YOLO COUNTY WATER GROUP/
SOLANO WATER AUTHORITY

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLIES

RECONNAISSANCE-LEVEL INVESTIGATION OF ALTERNATIVES

BORCALLI
&
ASSOCIATES

BORCALLI
&
ASSOCIATES
CONSULTING ENGINEERS

1513
SPORTS DRIVE
SUITE 12
SACRAMENTO
CALIFORNIA
95834
916/928-0036
FAX (916) 928-0615

MEMORANDUM

TO: Rick Wood
Solano Water Authority

FROM: Francis Borcalli

DATE: July 29, 1992

SUBJECT: Yolo-Solano Supplemental Water Supply Investigation
-- Modification of Selected Project

At your request, we have determined facilities sizes and estimated costs to enlarge the diversion and principal conveyance facilities of the selected project as described in our draft report entitled, Yolo-Solano Supplemental Water Supplies, Reconnaissance-Level Investigation of Alternatives, May 1992. This memorandum summarizes the results of our analysis.

Objective

The objective for enlarging the conveyance diversion and conveyance facilities is to deliver approximately 75 percent of the Solano demand on an agricultural water use schedule.

Facilities Sizing

To provide up to 75 percent of Solano's demand of 80,000 acre-feet per year on an agricultural schedule requires increasing the diversion at the Sacramento River from 203 cfs to 280 cfs. To accommodate this increase in flow, the pipeline from the river to the raw water reservoir near Woodland/Davis would be increased from an 84 inches to a 96 inches in diameter.

The sizes of other features affected by the enlarged diversion are presented on Figure A-1. These can be compared with the sizes shown for the selected project on Figure 7, Page 57, of the draft report.

The sizes of the various facilities to accommodate this increased capacity are reasonable. The factor that becomes most critical is the diversion. To the extent the diversion can be made by pumping underflow from the river, the diversion will be much more acceptable as compared with a diversion from the river directly. The larger the diversion, the more difficult it becomes to divert the entire amount as underflow.

The feasibility of pumping underflow by means of Ranney-type collectors or traditional wells is an important aspect of the preconstruction activities identified in the Development Schedule (Figure 8) of the draft report.

C-015640

Estimated Costs

Presented on Table A-1 is the estimated construction cost and allocation thereof among the respective participants. The total estimated bond debt is presented in Table A-2, and the annual costs according to the projected water us is presented on Table A-3. The information in these tables can be compared with that in Tables 11, 12, and 13 in the draft report.

Attachments

YOLO COUNTY WATER GROUP/
SOLANO WATER AUTHORITY

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLIES

RECONNAISSANCE-LEVEL INVESTIGATION OF ALTERNATIVES

BORCALLI
&
ASSOCIATES
CONSULTING ENGINEERS

TABLE 1

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

SOLANO COUNTY–SUPPLEMENTAL WATER DEMANDS

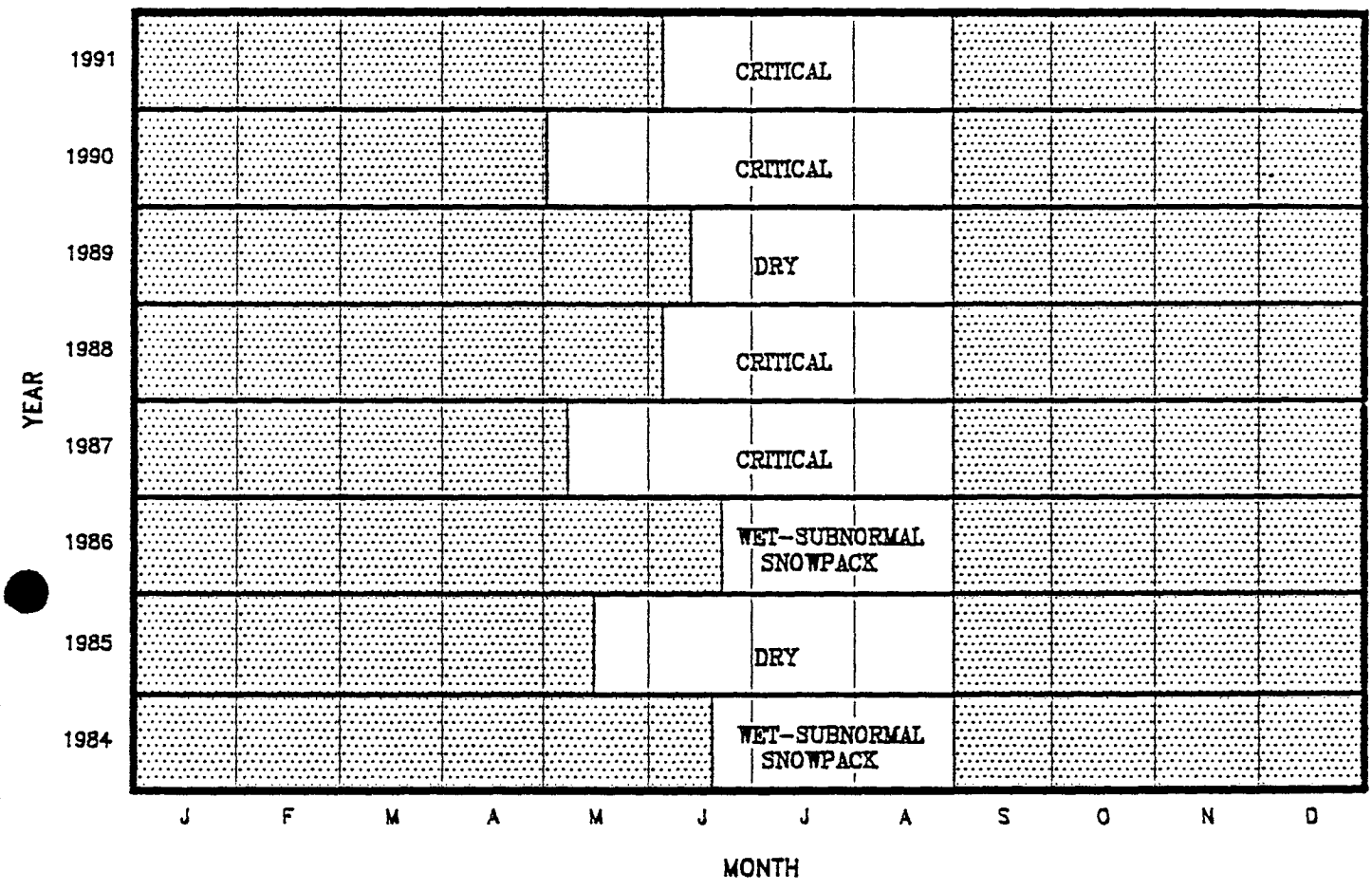
Agency	1992	1995	2000	2005	2010	2020	2030	Ultimate	Adopted [1]
Municipal & Industrial									
SID	–	–	3000	4000	5000	10000	10000	20000	10000
Fairfield	4000	6000	10000	15000	20000	25000	30000	30000	30000
Vacaville	2000	2000	4000	7000	10000	12000	15000	20000	15000
Rio Vista [2]	–	–	–	–	–	–	–	1500 [2]	–
Vallejo	–	–	2000	3000	5000	5000	5000	5000	5000
Benicia	1000	4000	5000	5000	5000	5000	5000	5000	5000
SCWA	–	1000	2000	3000	4000	5000	5000	10000	5000
Napa County	–	1000	2000	3000	4000	5000	5000	10000	10000
TOTAL	7000	14000	28000	40000	53000	67000	75000	101500	80000

[1] Supplemental demand used in this investigation.

[2] The water supply for Rio Vista would be diverted from the Sacramento River near Rio Vista.

/12/92

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
AVAILABILITY OF WATER FOR DIVERSION (TERM 91 METHOD)
SACRAMENTO – SAN JOAQUIN DELTA WATERSHED



LEGEND

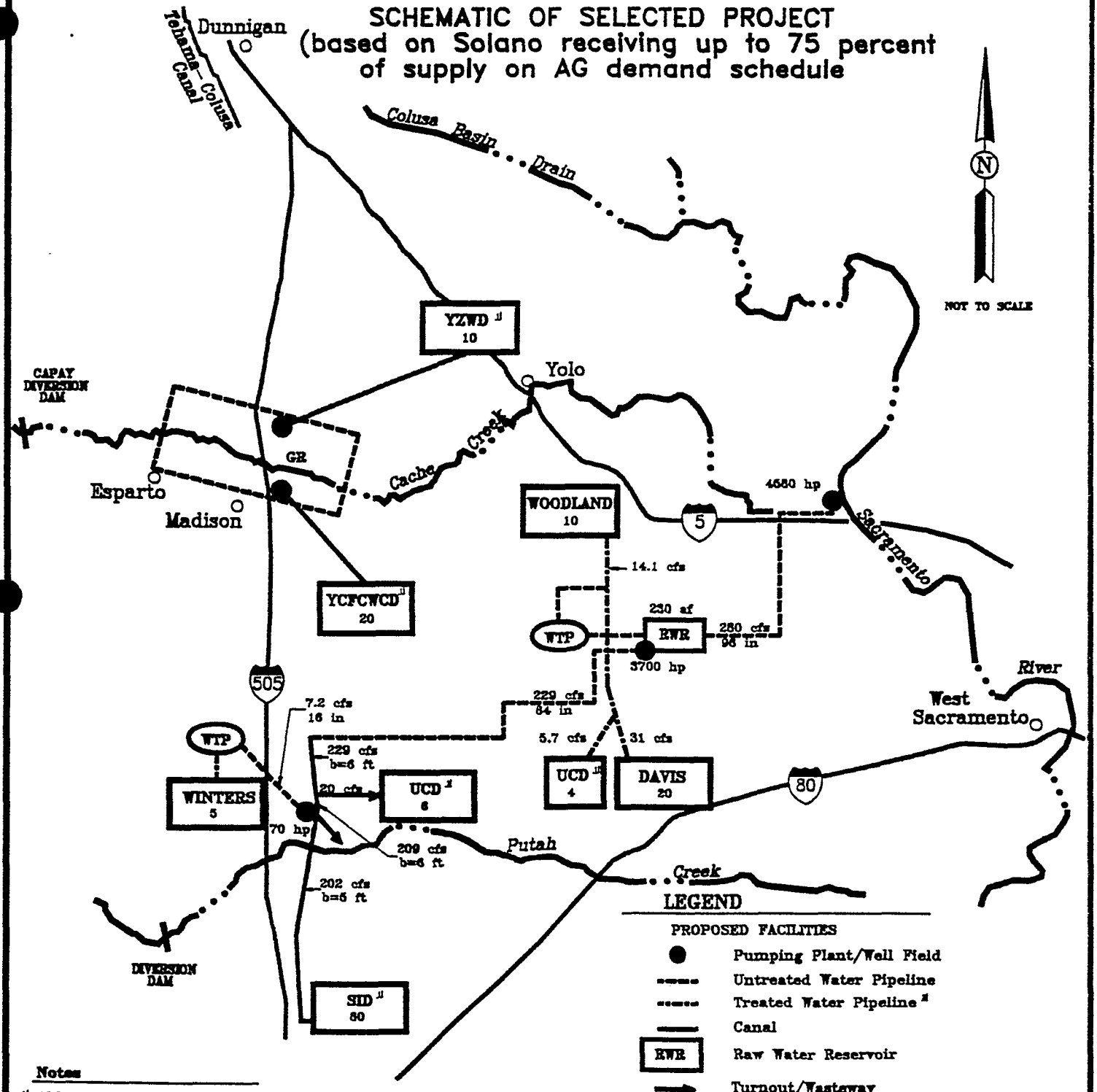
Water available for diversion

Water not available for diversion

CRITICAL Type of year

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

SCHEMATIC OF SELECTED PROJECT
(based on Solano receiving up to 75 percent of supply on AG demand schedule



Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo–Zamora Water District (YZWD)

[2] Facilities are shown for conceptual purposes.

LEGEND

PROPOSED FACILITIES

- Pumping Plant/Well Field
- Untreated Water Pipeline
- Treated Water Pipeline [2]
- Canal
- EWR — Raw Water Reservoir
- Turnout/Wasteway
- GR — Groundwater Reservoir
- WTP — Water Treatment Plant [2]
- DAVIS 20 — Water Purveyor; Water Supply, in 1,000 Acre-Feet

7/28/92

FIGURE A–1

C–015645

C-015645

TABLE A-1

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALLOCATION OF CONSTRUCTION COST FOR CONVEYANCE ALTERNATIVES
(based on Solano receiving up to 75 percent of supply on AG demand schedule)

Item	Total Project Cost $	Allocation of Costs Total Cost ($1,000)/Unit Cost ($/acre-feet)							
		Solano	Winters	UCD-Ag	UCD-Dom	Davis	Woodland	YCFCWCD	YZWD
Sacramento River Diversion and Pumping Plant	16,543,000	11,928,000	430,000	1,191,000	331,000	1,836,000	827,000	–	–
Davis-Woodland Pipeline	44,591,000	32,150,000	1,159,000	3,210,000	892,000	4,950,000	2,230,000	–	–
Davis-Woodland Raw Water Reservoir	699,000	504,000	18,000	50,000	14,000	78,000	35,000	–	–
Solano Pumping Plant	7,678,000	6,757,000	245,000	676,000	–	–	–	–	–
Solano Pipeline	26,267,000	23,115,000	841,000	2,311,000	–	–	–	–	–
Solano Canal									
Reach 1	3,505,000	3,084,000	113,000	308,000	–	–	–	–	–
Reach 2	779,000	752,000	27,000	–	–	–	–	–	–
Reach 3	4,284,000	4,284,000	–	–	–	–	–	–	–
Winters Pumping Plant	895,000	–	895,000	–	–	–	–	–	–
Winters Pipeline	921,000	–	921,000	–	–	–	–	–	–
Cache Creek Conjunctive Use Project	14,412,000	–	–	–	–	–	–	9,613,000	4,799,000
Total	120,574,000	82,574,000	4,649,000	7,746,000	1,237,000	6,864,000	3,092,000	9,613,000	4,799,000

TABLE A-2

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALLOCATION OF BOND DEPT
(based on Solano receiving up to 75 percent of supply on AG demand schedule)

Agency	Bond Dept, $
Solano	*104,069,000*
Winters	*5,864,000*
University of California	
Agricultural	*9,754,000*
Domestic	*1,565,000*
Davis	*8,629,000*
Woodland	*3,889,000*
YCFCWCD	*12,108,000*
YZWD	*6,047,000*
Total	*151,925,000*

7/28/92

C-015647

TABLE A-3
YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ESTIMATED ANNUAL COSTS
(based on Solano receiving up to 75 percent of supply on AG demand schedule)

2000
(First Year of Bond Repayment)

Item	Solano	Winters	UCD-Ag	UCD-Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	28,000	2,000	4,000	1,000	6,600	6,600	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	47.45	58.90	43.11	27.60	25.97	25.97	10.95	10.95
Bond Repayment, $/ac ft	236.61	186.65	155.25	99.60	83.23	37.51	38.54	38.50
Total Cost, $/ac ft	284	246	198	127	109	63	49	49

2014

Item	Solano	Winters	UCD-Ag	UCD-Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	57,500	3,000	5,400	2,000	12,800	10,000	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	78.02	101.16	76.52	41.85	40.92	39.49	18.44	18.44
Bond Repayment, $/ac ft	115.22	124.43	115.00	49.80	42.91	24.76	38.54	38.50
Total Cost, $/ac ft	193	226	192	92	84	64	57	57

2029
(Last Year of Bond Repayment)

Item	Solano	Winters	UCD-Ag	UCD-Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	75,000	4,200	6,000	3,200	16,700	10,000	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	100.02	129.26	99.10	52.12	52.05	51.38	23.82	23.82
Bond Repayment, $/ac ft	176.67	177.76	206.98	62.28	65.79	49.52	77.08	77.00
Total Cost, $/ac ft	277	307	306	114	118	101	101	101

7/28/92

C-015648

YOLO COUNTY WATER GROUP/
SOLANO WATER AUTHORITY

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLIES

RECONNAISSANCE-LEVEL INVESTIGATION OF ALTERNATIVES

D R A F T

MAY 1992

C-015649

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APPENDIX

CONCLUSIONS AND RECOMMENDATIONS

Several water supply and water conveyance alternatives were evaluated by Borcalli & Associates (B&A) in this reconnaissance-level investigation. B&A's conclusions and recommendations, to advance the prospects for obtaining supplemental water supplies in Yolo and Solano counties, are presented below.

Conclusions

From this investigation, it is concluded that:

1. The opportunity exists for Yolo and Solano counties (including Napa) to meet a substantial part of the supplemental water demands from the Sacramento River system by appropriation of water under the Watershed Protection Act of the California Water Code.

2. The best prospects for obtaining supplies to meet the supplemental water demands for the respective agencies in Yolo and Solano counties involve the following sources:

    - Appropriating water from Cache Creek for implementation of the Cache Creek Conjunctive Use Project.

    - Appropriating water from the Sacramento River for diversion east of Woodland.

    - Contracting with the Conaway Conservancy Group for purchase of transferable water.

    - Implementing a conjunctive water use program in Yolo and Solano counties.

3. The most feasible water conveyance system is a pumped diversion from the Sacramento River east of Woodland, using pipelines and canals as shown in the Schematic of Selected Project on the following page.

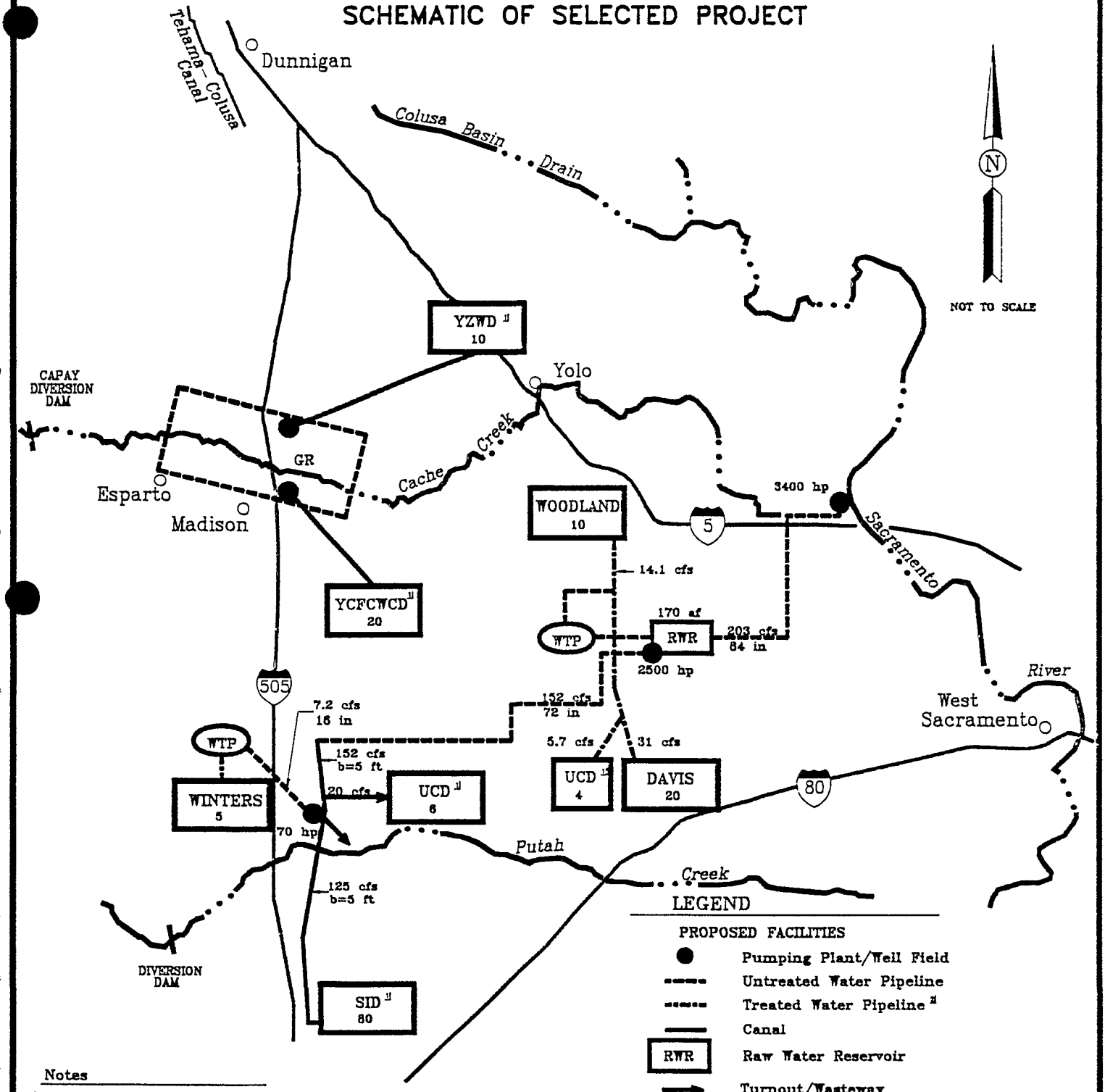
4. The estimated cost for delivery of raw (untreated) water to the respective entities in the year 2000, 2014, and 2029, is as follows:

Agency	2000		2014		2029	
	Amount ac ft/yr	Cost $/ac ft	Amount ac ft/yr	Cost $/ac ft	Amount ac ft/yr	Cost $/ac ft
Solano	28,000	230	51,500	166	75,000	236
Winters	2,000	276	3,000	245	4,200	336
UCD-Ag	4,000	237	5,400	220	6,000	357
UCD-Dom	1,000	146	2,000	101	3,200	126
Davis	6,600	124	12,800	91	16,700	129
Woodland	6,600	70	10,000	68	10,000	110
YCFCWCD	20,000	51	20,000	59	20,000	104
YZWD	10,000	51	10,000	59	10,000	104

5. The estimated bond debt to develop the project and allocation among the respective entities is as follows:

Entity	Bond Debt, $
Solano	80,274,000
Winters	6,810,000
University of California Agricultural Domestic	 12,190,000 1,861,000
Davis	10,140,000
Woodland	4,572,000
YCFCWCD	12,676,000
YZWD	6,324,000
TOTAL	134,847,000

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
SCHEMATIC OF SELECTED PROJECT



Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo–Zamora Water District (YZWD)

[2] Facilities are shown for conceptual purposes.

C-015655

Recommendations

Based upon the conclusions of this investigation, it is recommended that:

1. The respective agencies make a determination of their interest to continue to participate in the proposed Yolo-Solano water supply project.

2. The agencies interested in participating in the proposed project commence implementation of the project development program by:

    a. executing the participation agreements;

    b. initiating the preparation of application(s) for appropriating water, and the negotiation of an agreement with the Conaway Conservancy Group for the use and management of transferable water; and

    c. investigating the most feasible means for diverting water from the Sacramento River including: a well field, Ranney-type collectors, Ranney-type water intake constructed on the land side of the river levee, and a direct pump diversion on the water side of the river levee.

INTRODUCTION

This investigation of alternatives to provide supplemental water supplies to water districts and cities in Yolo and Solano counties was undertaken jointly by the Yolo County Water Group[1/] and the Solano Water Authority[2/]. Also the County of Napa is participating through the Solano Water Authority.

1/ The Yolo County Water Group, initiated by the Yolo County Flood Control & Water Conservation District, is an informal association of agencies in Yolo County involving the cities of Davis, Winters, and Woodland, the University of California at Davis, the Yolo-Zamora Water District, and the Yolo County Flood Control & Water Conservation District.

2/ The Solano Water Authority is a Joint Powers Authority that includes the cities of Benicia, Fairfield, Vacaville, Vallejo, the Solano Irrigation District, Reclamation District No. 2068, and Solano County.

PURPOSE OF INVESTIGATION

The purpose of this investigation is to identify and evaluate the reasonable alternatives for water supply and conveyance to meet the supplemental water demands for water districts and cities in Yolo and Solano counties, with provision for making water available to Napa County by exchange. The results of this investigation are to be used by the respective entities to determine if they are interested in continuing to pursue the acquisition of supplemental water supplies to meet their long-term needs.

Also, during the 1986-88 period, the Yolo County Flood Control & Water Conservation District (YCFCWCD) investigated the opportunities to develop an increment of new water within the Cache Creek watershed. Upon completing this work, the District concluded that although projects existed that appeared technically feasible, none were feasible at the time due to economic, environmental, and political considerations.

With few options available for obtaining supplemental water, the District sent a letter to the Bureau asserting that the watershed protection statutes of the California Water Code gave areas of origin a priority for a water service contract.

The Bureau responded several months later, indicating that the Watershed Protection Act afforded no priority for a water service contract, but that it does afford a priority with respect to water appropriations.

BASIS FOR ANALYSIS

In performing this reconnaissance-level investigation, information was used from other sources and assumptions were made with respect to conditions that could occur in the future. The use of this information and the assumptions made are regarded as being reasonable for purposes of this work. The principal information used and assumptions made include the following:

1. All facilities are to be constructed entirely by the local entities with no federal participation.

2. The water conveyance facilities are sized to provide the peak monthly capacity for the designated demand.

3. The conveyance facilities are only for the delivery of raw water supplies.

4. Pipelines discharging from pumping plants are sized to convey the design flow with a velocity within the range of 5 ft/sec to 6 ft/sec. Pipelines having gravity flow are sized in accordance with the available head. Headlosses within pipelines are computed using the Hazen-Williams formula and a friction coefficient of 140.

   Canal sections are sized using the Mannings formula and a roughness coefficient of 0.014.

   Horsepower and energy requirements of pumping plants are computed with an overall plant efficiency of 70 percent.

5. Construction costs are developed from information obtained from a number of sources. The cost information is updated to a July 1991 dollar base using the Bureau's Construction Cost Trends.

Canals -- Construction cost estimates for canals, appurtenances, and right-of-way acquisition are developed using information prepared by the Bureau for a 1980 cost estimate of the West Sacramento Canal Unit.

Pipelines -- Construction cost estimates for pipelines are developed using construction bid prices received by the California Department of Water Resources (DWR) for the various reaches of the North Bay Aqueduct, construction bid prices received by the City of West Sacramento, unit prices received from pipe manufacturers, and the Dodge Heavy Construction Cost Data. The cost of appurtenances and crossings are estimated at 20 percent of the construction cost. The right-of-way along the pipeline is 40 feet in width, and the cost is estimated at $5,000 per acre.

Pumping Plants -- Construction cost estimates for pumping plants and appurtenances are based upon construction bid prices received for the Cordelia Pumping Plant, the Barker Slough Pumping Plant, and experience with similar projects. Costs for mechanical and electrical features are based upon the following formula:

$$\text{July 1991 Cost} = \$220{,}000\ (\text{MGD})^{.37} + 1890\ (\text{HP})^{.78}$$

Costs for fish screens are based upon information obtained from the California Department of Fish and Game. The cost estimates reflect construction of mechanical, electrical, civil, and, when appropriate, fish screening facilities.

6. With the exception of dams, a 25 percent contingency is added to construction and right-of-way costs to account for adjustments in the project and appurtenant features that will occur as surveys and more detailed engineering analysis are performed. A 30 percent contingency is used for estimates involving dams and reservoirs.

SUPPLEMENTAL WATER DEMANDS

Supplemental water demands were determined by the respective participants for their particular planning horizons. The total supplemental water demand for the participants in Yolo and Solano counties is described below.

Yolo County

Agricultural Use

Supplemental water for agricultural use is required for the Yolo County Flood Control & Water Conservation District, the Yolo-Zamora Water District, and the University of California at Davis.

The Yolo County Flood Control & Water Conservation District (YCFCWCD) -- The YCFCWCD's supplemental demand is 40,000 acre-feet per year. Approximately 20,000 acre-feet per year is to "firm up" existing supplies and provide for irrigation of suitable lands that remain unirrigated along the perimeter of the district's boundaries. This 20,000 acre-feet represents a 10 percent increase in the YCFCWCD's demand for supplies of approximately 190,000 acre-feet.

In addition, 20,000 acre-feet per year will be required to replace the projected increase in municipal water use around Clear Lake in Lake County. The YCFCWCD would begin using the full amount of water as soon as it becomes available. The supplemental water would be used first with water from the YCFCWCD's Clear Lake supply. The YCFCWCD's Indian Valley Dam and Reservoir would continue to be used for carryover storage and water would be drawn from storage when Clear Lake and the supplemental supplies were not adequate to meet demand.

Using 75 percent imported water requires approximately 20,000 acre-feet per year. For the first year of water delivery, it is assumed that 50 percent of its demand would be met using imported water supplies and would increase to 75 percent by the year 2010.

City of Woodland -- The City of Woodland has estimated its supplemental water supply to the year 2015, which was the time frame used by the Bureau in December 1989, in preparing its Draft EIS for water contracting. Using imported supplemental water to meet 50 percent of its demand requires approximately 10,000 acre-feet per year at 2015. It is assumed that Woodland would use imported supplemental water to meet 50 percent of its demand during the first year of water delivery.

City of Winters -- The City of Winters has indicated that groundwater supplies are sufficient to meet increased water demand through the General Plan period to the year 2010, and that over the long term approximately 5,000 acre-feet per year may be required. For purposes of this investigation, it has been assumed that the City of Winters would begin to incorporate imported supplemental supplies in the amount of 1,000 acre-feet per year beginning in the year 2000.

It is also assumed that the City of Winters' use of imported supplies would increase uniformly to 5,000 acre-feet per year at 2040.

Solano County

All imported supplemental water supplies for Solano County are for municipal and industrial purposes. Member agencies of the Solano Water Authority have estimated their demand for imported supplemental supplies through the year 2030. To facilitate an exchange of water for the benefit of Napa County, the demand for Solano County includes an amount of 10,000 acre-feet per year for Napa. This projection. The projected supplemental water demand for each entity is presented in Table 1.

TABLE 1
YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
SOLANO COUNTY–SUPPLEMENTAL WATER DEMANDS

Agency	1992	1995	2000	2005	2010	2020	2030	Ultimate	Adopted [1]
Municipal & Industrial									
SID	–	–	3000	4000	5000	10000	10000	20000	10000
Fairfield	4000	6000	10000	15000	20000	25000	30000	30000	30000
Vacaville	2000	2000	4000	7000	10000	12000	15000	20000	15000
Rio Vista [2]	–	–	–	–	–	–	–	1500 [2]	–
Vallejo	–	–	2000	3000	5000	5000	5000	5000	5000
Benicia	1000	4000	5000	5000	5000	5000	5000	5000	5000
SCWA	–	1000	2000	3000	4000	5000	5000	10000	5000
Napa County	–	1000	2000	3000	4000	5000	5000	10000	10000
TOTAL	7000	14000	28000	40000	53000	67000	75000	101500	80000

[1] Supplemental demand used in this investigation.

[2] The water supply for Rio Vista would be diverted from the Sacramento River near Rio Vista.

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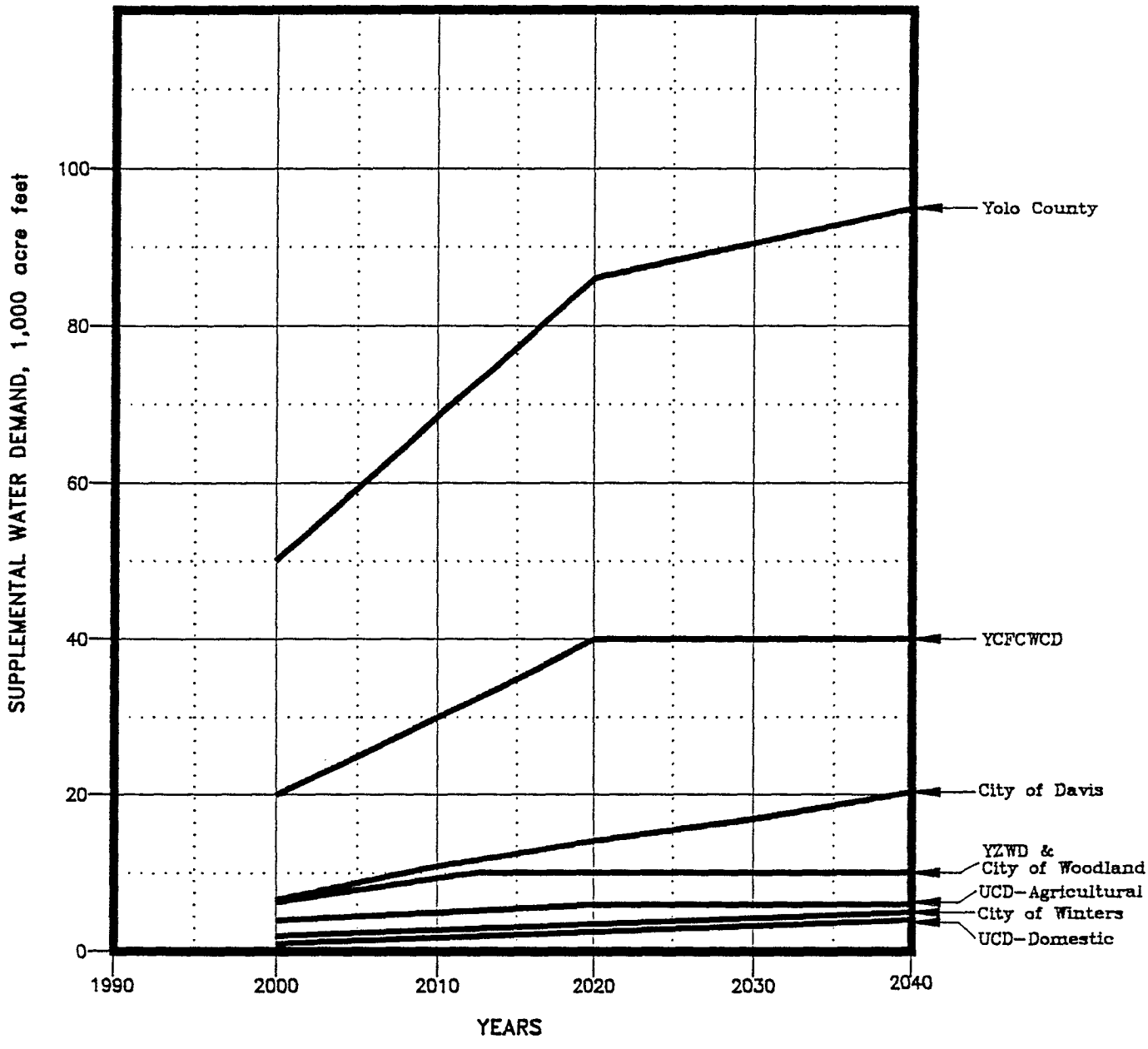
Summary

Presented in Figures 1, 2, and 3, respectively, is the projected supplemental water demand for Yolo County, Solano County, and both counties combined. The total supplemental demand being considered in this investigation is as follows:

Yolo County	Agriculture	56,000 acre-feet
	Municipal	39,000
Solano County with Napa County	Municipal	80,000
		175,000 acre-feet

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
YOLO COUNTY-PROJECTED SUPPLEMENTAL WATER DEMAND



5/12/92

FIGURE 1

C-015666

C-015666

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
SOLANO COUNTY–PROJECTED SUPPLEMENTAL WATER DEMAND

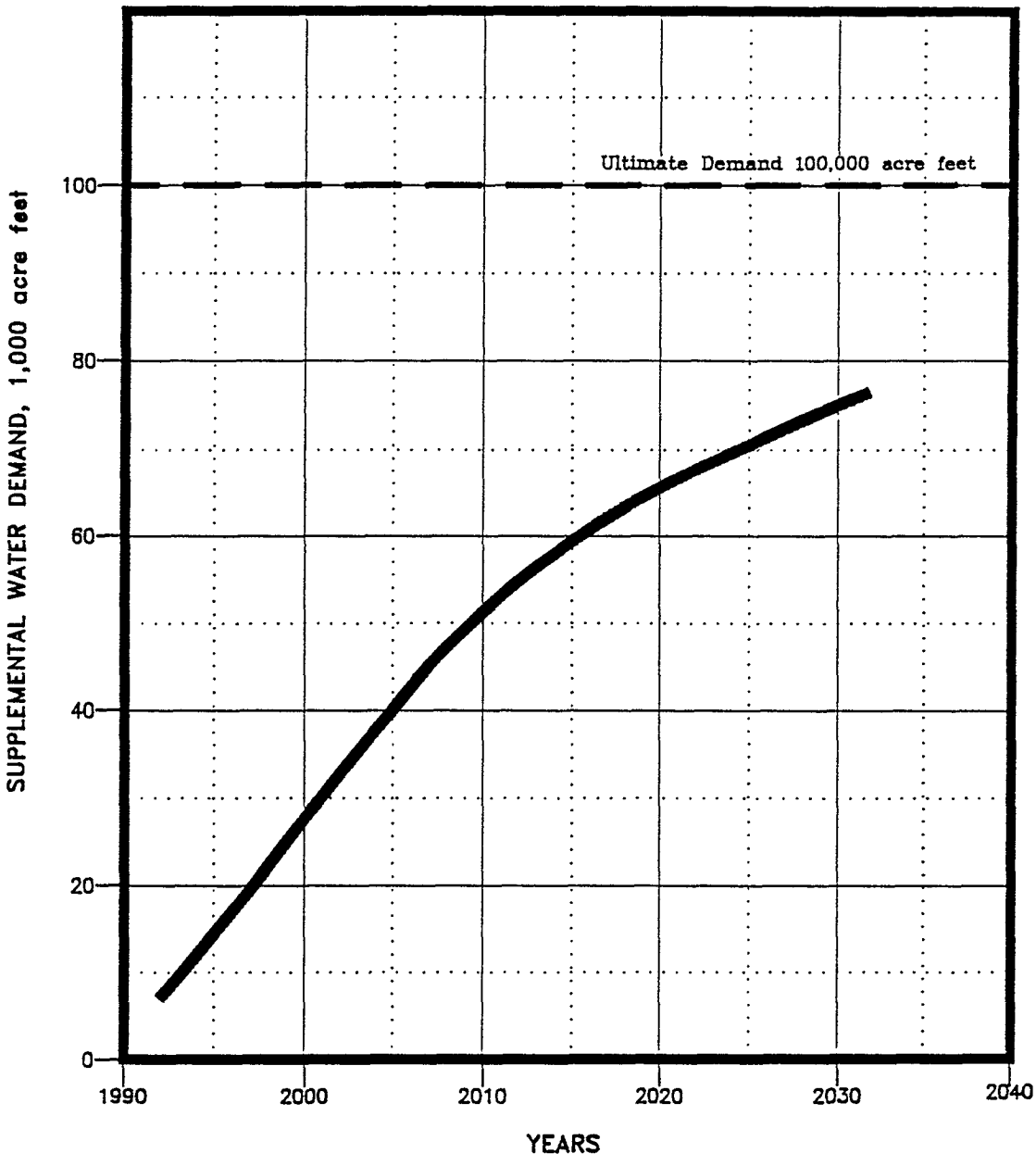


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FIGURE 2

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

YOLO & SOLANO COUNTIES–PROJECTED SUPPLEMENTAL WATER DEMAND

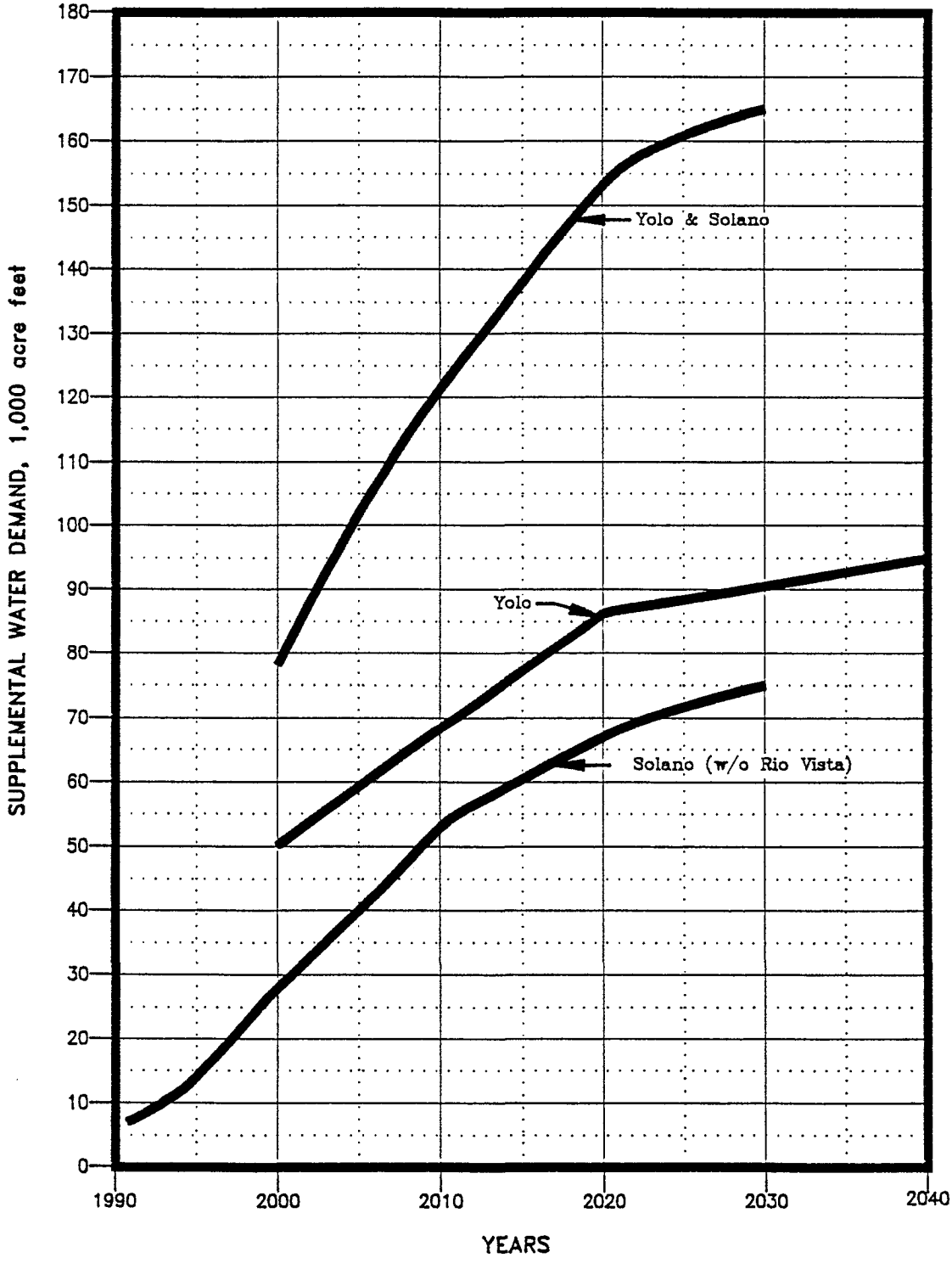

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FIGURE 3

C—015668

C-015668

WATER SUPPLY ALTERNATIVES

As summarized in the preceding section, the total supplemental water demand being considered by agencies in Yolo and Solano counties amounts to 175,000 acre-feet, of which 56,000 acre-feet is for agricultural use and the balance of 119,000 acre-feet is for municipal, industrial, and domestic purposes. Recognizing that no single source of water would be adequate to meet these demands, several alternatives are identified and evaluated to determine what combinations of alternatives offer the best opportunity for meeting the supplemental demands for the two counties.

The various sources of water identified for evaluation are presented in Table 2. Also noted in the table are the legal aspects for acquiring the right to use the supplies from the respective sources. Each of the alternative sources of water is discussed below.

Cache Creek Conjunctive Use Project

Concept -- Although the YCFCWCD owns and operates two reservoirs in the Cache Creek watershed, Clear lake and Indian Valley, a substantial portion (42 percent) of the Cache Creek watershed is unregulated. As a consequence, substantial runoff occurs downstream of both reservoirs in some years. In many years, flood releases are made from Clear Lake as well. The only way to use any of this runoff is to develop additional storage in the system.

The YCFCWCD has long recognized that Cache Creek, between Capay and Yolo, is an important resource that can be managed to provide a new increment of water. Implementation of a conjunctive use project along this reach of Cache Creek could provide a new source of water supply. The new supply would be obtained by managing the groundwater basin to reduce groundwater levels on a predetermined operating schedule to provide storage to capture currently "unmanaged" water by groundwater recharge.

TABLE 2

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

WATER SUPPLY ALTERNATIVES

Source	Legal
Cache Creek Conjunctive Use	Water Appropriation
Cache Creek Blue Ridge Dam	Water Appropriation
Cache Creek Thurston Lake	Water Appropriation
Federal Central Valley Project	Water Purchase Contract
State Water Project	Water Purchase Contract
Glenn–Colusa Irrigation District	Water Purchase Contract
Sacramento Valley Surface Water Rights Transfer	Water Purchase/ Transfer Agreement
Cottonwood Creek	Water Appropriation
Conaway Conservancy Group	Water Purchase/ Transfer Agreement
Sacramento River	Water Appropriation

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The proposed plan would require construction of a water level control structure on Cache Creek in the vicinity of the Moore Canal and modification of the Capay Diversion Dam. The instream facilities would operate in conjunction with recharge areas to expand the recharge areas beyond that of the Cache Creek channel alone. In addition to wells, groundwater could be extracted by means of pumping facilities operating within open pits. Water from the project would be delivered to the West Adams Canal, the East Adams Canal, and the Moore Canal. This project could be implemented immediately by working out a program with owners overlying the basin.

Quantity -- A systems operations model was developed to estimate the average yield provided by the conjunctive use project. The model reflects the hydrologic period from 1921 through 1990; the operational constraints on Clear Lake and Indian Valley; and the recharge, storage, and extraction characteristics of the groundwater basin.

The results indicate that the conjunctive use project could yield from zero to 60,000 acre-feet in a given year depending upon hydrologic and demand conditions. An average annual yield of 30,000 acre-feet is regarded as being reasonable. Recognizing that this evaluation is based upon very limited data and generalized assumptions regarding the physical characteristics of the system, a detailed hydrogeologic analysis of the basin will be required to confirm the potential for this project and to establish a sound basis for mitigation of impacts and operations.

Water Entitlement -- Implementation of the Cache Creek Conjunctive Use Project will require obtaining appropriative water rights for the amount of water diverted from Cache Creek into the groundwater basin. Water that would be recovered by the project for beneficial use in Yolo County presently constitutes a part of the Delta outflow or may be diverted at the state or federal pumping plants for export from the Delta. To the extent the water developed by the project is used for

beneficial purposes locally, the watershed of origin statutes of the California Water Code provides the priority needed to develop the supplies.

Cost -- For purposes of this study, costs for this source of water consist of the costs for facilities and operations and maintenance. The total cost of the facilities is estimated at $14,412,000, and the annual O&M costs are estimated at $207,000. To the extent existing wells are used, the facilities' cost will be less.

The proposed conjunctive use project would result in groundwater levels being lower, more often. As proposed, the minimum levels would be exceeded. The extent of the impacts will be determined by using a groundwater model that would have to be developed during the detailed feasibility study and EIR process. This impact would be mitigated by compensating affected users, as appropriate. The compensation would be a part of the project operation and maintenance costs.

The proposed project has the potential of creating higher levels of boron in the westerly portion of the groundwater basin. This potential would require careful consideration as more detailed analyses are conducted.

Environmental -- Three bank swallow (Riparia riparia) colonies are known from the reach of Cache Creek from Capay to Yolo. The bank swallow is listed as threatened by the Department of Fish and Game; however, it has not federal status. Bank swallows are colonial nesters and nest primarily in riparian and other lowland habitats. They require vertical banks with fine-textured sandy soils near streams, rivers, or lakes to dig nesting holes. They generally return to the same nesting colonies year after year.

To the extent the project affects vertical banks, it may have an impact on the bank swallow.

Viability -- The proposed Cache Creek Conjunctive Use Project appears to be a viable source of supplemental water for Yolo County. Due to the concentrations of boron in water from the Cache Creek system directly, it is not a viable source of water for Solano County.[3/] Technically, the concept is sound and consistent with state and federal water policy for improving management of water resources in California.

Cache Creek-Blue Ridge Dam and Reservoir

Concept -- In September 1986, the YCFCWCD completed a reconnaissance-level investigation of the Cache Creek watershed. The purpose of the investigation was to examine multipurpose projects to provide water supply; resolve or minimize problems of flooding, bank erosion, and sedimentation; and improve water quality in the lower Cache Creek area. A dam and reservoir at Blue Ridge were selected as the recommended alternative.

As a result of the 1986 study by the YCFCWCD, the U. S. Army Corps of Engineers (Corps) was authorized in Fiscal year 1986/87 to complete a cost/benefit analysis of a dam and reservoir, having a 700,000 to 900,000 acre-feet of storage capacity, at Blue Ridge. The Corps concluded that the cost/benefit of the flood control and erosion protection aspects of the project amounted to approximately $10,000,000 in benefits. In relation to the overall cost of the project, the flood control benefits are incidental.

The earlier studies of a dam and reservoir at Blue Ridge involved developing a "firm" supply and resolving flooding, erosion, and water quality issues. For purposes of this investigation, the operational concept of a dam and reservoir at Blue Ridge has been changed.

3/ Criteria established by Solano County precludes the importation of water with boron concentrations common to water supplies in Cache Creek and Yolo County generally.

It is proposed that the Blue Ridge project be operated on an average yield basis rather than on a firm yield basis. Operating in this manner would reduce the size of the facilities required and would use the available water resources from the Cache Creek watershed more effectively. An average yield operational scheme is possible due to the excellent opportunities for conjunctive use with groundwater throughout much of the county. Water from the Blue Ridge dam and reservoir would be diverted from Cache Creek for distribution using existing facilities of the YCFCWCD and some of the same facilities required under the Cache Creek Conjunctive Use Project.

Quantity -- A systems operation model was developed to estimate the size of a dam and reservoir at Blue Ridge, and the corresponding average yield. The model reflects the hydrologic period from 1921 through 1985; the operational constraints on Clear Lake and Indian Valley; and various demand conditions.

A storage capacity of 600,000 acre-feet was determined to be appropriate for the dam and reservoir at Blue Ridge. A reservoir of this capacity, when operated in conjunction with Clear Lake and Indian Valley, was found to have the ability to meet 100 percent of the existing YCFCWCD demands of 190,000 acre-feet, plus supplemental water demands of 85,000 acre-feet in all but two years of the study period. Deficits in the two years were approximately 68 percent of the total demand. For purposes of this study, the dam and reservoir at Blue Ridge was assigned an average annual yield of 85,000 acre-feet.

Water Entitlement -- Utilization of a dam and reservoir on Cache Creek at Blue Ridge would require appropriating water. As was noted under the conjunctive use project, the appropriation of water for beneficial use locally should enjoy the priorities afforded by the Watershed Protection Act.

Cost -- The project cost for a Blue Ridge dam and reservoir having a storage capacity of 600,000 acre-feet was estimated to be approximately $308,000,000, in July 1991 dollars. The project costs include construction costs; contingencies at 30 percent; and engineering, environmental assessment, and construction management at 22 percent. At an average yield of 85,000 acre-feet, the unit cost for this source would be about $3,600/acre-feet. At this time, it is not possible to estimate the costs for mitigating environmental impacts.

Environmental -- A 600,000 acre-foot dam and reservoir at Blue Ridge would have significant environmental impacts. Some of these impacts are described below.

The proposed reservoir would reportedly displace habitat of the bald eagle and a Tule Elk herd. The degree to which these impacts could be mitigated is currently unknown.

Summer rafting along Cache Creek from Highway 20 on the North Fork to Rumsey was made attractive with the completion of Indian Valley Dam and Reservoir in 1975. Much of this reach would be inundated by the proposed reservoir.

The Blue Ridge reservoir would inundate reaches of Cache Creek that experience significant stream bank erosion. Doing so would reduce the sediment yield of the basin and extend the life of the Cache Creek Settling Basin.

The Blue Ridge dam and reservoir may reduce the boron concentrations of Cache Creek. This would be accomplished through the dilution of groundwater inflow with storm water runoff. A reduction in boron characteristics was experienced at Indian Valley dam and reservoir.

Viability -- The proposed dam and reservoir at Blue Ridge appears to be a viable project from a technical standpoint; however, the project is less attractive considering the economic and environmental factors.

Cache Creek-Thurston Lake Pumped Storage and Conjunctive Use

Concept -- The Thurston Lake Project would be operated in conjunction with the Cache Creek Conjunctive Use Project described previously. Thurston Lake is a natural lake located near the southwest end of Clear Lake. The elevation of the water level in Thurston Lake is approximately 1,400 feet/msl, whereas the elevation of Clear Lake is approximately 1,328.2. The topographic configuration of land forming Thurston Lake creates a potential for storing up to 300,000 acre-feet of water. The concept examined by agencies from Solano, Lake, and Yolo counties in 1980, involved the pumping of water from Clear Lake into Thurston Lake in the late fall to spring period, thereby creating space in Clear Lake to store runoff that otherwise would create flooding of property around Clear Lake and then be released as flood runoff. The Corps is presently evaluating the Thurston Lake Pumped Storage Project along with several other alternatives for alleviating the problems of flooding around Clear Lake.

Operationally, water levels in Clear Lake would be lowered to zero on the Rumsey Gage beginning in November of each year by pumping water into Thurston Lake. In years when Clear Lake would not fill to Rumsey 7.56 feet, water would be withdrawn from Thurston Lake so that the water level in Clear Lake from April through September would be at the same level as would have occurred without the Thurston Lake Project. In years when Clear Lake would fill to Rumsey Gage 7.56 feet or greater, water withdrawn from Thurston Lake would constitute a new increment of water.

Quantity -- Operational studies were performed with Thurston Lake operating in conjunction with the YCFCWCD's Clear Lake and Indian Valley Dam and Reservoir and with the proposed Cache Creek Conjunctive Use Project described previously. On the basis of the operations studies, the yield from the Thurston Lake Project, with 250,000 acre-feet of storage and the groundwater recharge project, is estimated to be approximately 85,000 acre-feet per year. In a series of dry years such as the hydrologic period 1928-34 significant deficiencies would occur.

Water Entitlement -- Water developed from the Thurston Lake Pumped Storage Project would require an appropriation through the SWRCB. The project could be developed as a local project with federal participation through the Corps for the flood control aspects. Alternately, Thurston could be a federal project.

As was noted for the Cache Creek Conjunctive Use Project and the Blue Ridge Project, it appears that water could be appropriated by exercising provisions of the Watershed Protection Act.

Cost -- The estimated cost for the Thurston Lake Pumped Storage Project is based upon updating information prepared in the 1980 investigation performed for Solano, Lake, and Yolo counties, and adding costs for sealing or lining the reservoir. The total estimated cost for the Thurston Lake Project alone, in July 1991 dollars, is $128,139,000. Combined with the Cache Creek Conjunctive Use Project, the total cost is estimated to be $142,281,000, or $1,670 per acre-foot.

Environmental -- No sensitive species are known from the area between Clear Lake and Thurston Lake; however, several sensitive plants are known from the area south of Thurston Lake near Lower Lake Road. These plants are all associated with vernal pools. If this alternative was selected, a ground survey of the proposed tunnel route would have to be conducted to determine whether any vernal pools were present in the construction corridor.

Insofar as flood releases at Clear Lake Dam contribute significantly to the population of carp in Cache Creek downstream of Clear Lake Dam, the prey for bald eagles could be reduced.

On the other hand, however, the accessibility to fish in Cache Creek by eagles should be improved since flood releases at Clear Lake Dam would be minimized. If deemed necessary, carp could be netted in Clear Lake and released downstream of Clear Lake Dam.

In recent communications with Corps staff, it appears that the annual lowering of Clear Lake to near zero Rumsey during the late fall months could be advantageous for wildlife habitat in the area of Anderson Marsh.

Viability -- The concept of the Thurston Lake Pumped Storage Project appears viable from an economic standpoint; however, the geotechnical aspects of storing water there need to be addressed from the standpoint of leakage and seismic conditions. Water quality aspects of water stored in Thurston Lake need to be thoroughly evaluated as well. These items are being given some consideration at this time in the investigation being performed by the Corps.

Federal Central Valley Project

Concept -- Plans for agencies in Yolo and Solano counties to enter into a water service contract with the Bureau go back as far as the 1950's. The prospects of a water service contract were thought to be reasonable until December 1989, when the Bureau completed its Draft EIS for Water Contracting. Subsequent averse comments by the public and the EPA on the document, together with the SWRCB commencing its process for establishing new standards for the Bay-Delta Estuary, virtually brought the Bureau's efforts to a standstill. As a consequence, the Bureau ceased all efforts for contracting what were thought to be unallocated yield from the CVP. The Bureau is considering options for a

comprehensive CVP water management plan, including marketing of water from the Sacramento River system; however, there is no definitive schedule for this plan.

What was indicated to be in excess of one million acre-feet of unallocated CVP yield in the 1987-89 period, now appears to be nil. This is especially true considering efforts through the legislative process to allocate substantial quantities of water to restore fish and wildlife resources.

In view of the dim prospects for an allocation of water from the CVP, the YCFCWCD sent a letter to the Bureau on February 21, 1991, asserting that the Watershed Protection Act provided a priority over contracts for water service to areas outside the Sacramento River watershed. The Bureau responded in November 1991, indicating that the Watershed Protection Act did not give any potential water user, irrespective of location in the system, any priority for a water service contract. Also, information provided by the Bureau indicated that although the Watershed Protection Act did not provide any priority for a water service contract, it does allow water users within the watershed of origin to appropriate water under a priority senior to rights of the Bureau or DWR.

Quantity -- The Draft EIS for Water Contracting acknowledged a reasonable demand for Yolo and Solano county entities of 142,000 acre-feet per year, at the year 2015. In the short term, however, the prospects of obtaining any water from the CVP are extremely limited.

Water Entitlement -- As noted above, water from the Federal CVP would be through a water service contract with the Bureau.

Cost -- The cost for water from the CVP currently would be in the range of $15 per acre-foot and $26 per acre-foot for agricultural and municipal water users, respectively.

Environmental -- To the extent the SWRCB determines that higher standards are required to protect the Bay-Delta Estuary, additional water releases may be required from the CVP, thus creating an even greater demand on the supplies that are subject to being reduced for mitigation of project-associated impacts. Diversion of water from the CVP could be made from the Sacramento River through the existing Red Bluff Diversion Dam or a new diversion near Woodland.

Until recently, mortality factors affecting juvenile chinook salmon downstream migrants at the Red Bluff Diversion Dam included entrainment into the Tehama-Colusa Canal, injury from the louver bypass structure, and predation above and below the dam. The louvers at the Tehama-Colusa Canal were replaced with a horizontal axis drum screen in 1990. It has been very successful, operating at close to 100 percent efficiency. Over the next 10 years fish ladders also may be placed on the dame to assist migrating fish.

Predation by Sacramento squawfish on juvenile chinook salmon migrants is believed to be the most significant factor of mortality at the Red Bluff Diversion Dam, particularly during spring months when adult squawfish accumulate below the dam during their spawning migration.

A new diversion near Woodland would have to be designed with state-of-the-art screening devices.

Viability -- In view of the status of the Bureau's water contracting efforts, the process underway by the SWRCB to set new standards for the Bay-Delta Estuary, and legislative efforts to have the CVP mitigate past environmental damage, a water service contract for CVP water does not appear viable at this time.

State Water Project

Concept -- Unlike the Federal CVP, the State Water Project (SWP) is unable to meet its contract commitments presently as it is "over subscribed." The firm yield of the SWP is approximately 2.4 million acre-feet per year. Contracted requests for delivery of entitlement water exceed the firm yield of the SWP in 1987. Nevertheless, DWR, as noted in a letter to Yolo County Supervisor Betsy A. Marchand dated February 21, 1992, is obligated by law not to deprive areas of origin of water reasonably required to supply their beneficial needs. Accordingly, based on this statutory requirement, DWR has been and is willing to contract with agencies in such areas to supply SWP water.

Although Solano County is presently a contractor of the SWP, no established process exists by which to assess the terms of a contractual arrangement to add a new area of origin contractor to the SWP.

Quantity -- The quantity of water and associated terms and conditions that could be negotiated with DWR for a water supply contract cannot be identified at this time. Certainly, however, with the addition of new supplies, additional contract entitlements would tend to increase the deficiencies that all contractors would be required to take. The extent to which the area of origin could receive some preferential supply during water short periods cannot be anticipated at this time.

Water Entitlement -- As noted previously, water from the SWP would be available through a water supply contract.

Cost -- Existing contractors pay a Delta water charge for their proportional share of the cost to develop SWP water supplies. The Delta water rate presently is $20.27 per acre-foot, and is expected to increase substantially in the future under terms of water contracts as costs are incurred to provide new water supplies.

Environmental -- To the extent the SWRCB determines that higher standards are required to protect the Bay-Delta Estuary, additional water releases from the SWP may be needed, thus creating an even greater constraint on the SWP's ability to meet its contract entitlements.

With respect to diverting water under contract with the SWP, this could be accomplished at the Red Bluff Diversion Dam with the appropriate exchanges, or a new diversion near Woodland. Environmental considerations concerning the diversion would be similar to those described under the CVP.

Viability -- Although by virtue of the Watershed Protection Act, it appears that DWR is obligated to provide areas of origin with reasonable amounts of needed water supplies, the prospect for being able to negotiate acceptable terms for a water supply contract does not appear favorable in view of the SWP's current supply-demand situation.

Glenn-Colusa Irrigation District

Concept -- The concept under consideration with respect to the Glenn-Colusa Irrigation District (GCID), is that investments would be made within GCID for conservation measures or a conjunctive use program to "free up" an increment of "new water." This water could in turn be made available to meet a portion of the supplemental water demand.

Quantity -- No definitive program has been formulated at this time; however, it is estimated that in the order of 60,000 acre-feet of water could be made available annually. Smaller increments of water may be more readily available.

Cost -- The cost for each increment of water will depend on the cost involved to make it available. Theoretically, the first increment of "new" water would be relatively inexpensive; however, each increment will become progressively more costly.

Water Entitlement -- Entitlement to water that would be made available by conservation, groundwater development, or other means would be through contracts or agreements negotiated with GCID.

Environmental -- Without knowing any details of prospective measures at this time, it is not possible to comment on the environmental aspects of the water supply alternative.

Viability -- Regarding conservation, the recovery of water before it leaves the boundaries of GCID may offer some opportunity, although such an operation will have an impact on downstream water users along the Colusa Basin Drain. A conjunctive use program could provide some opportunity to provide a "new" increment of water; however, the magnitude is uncertain at this time.

Sacramento Valley Surface Water Rights Transfer

Concept -- Waikea, Incorporated, contacted several agencies in Yolo and Solano counties to determine if there was an interest to purchase, into perpetuity, pre-1914 water rights from owners of ranches in the Northern Sacramento Valley. This water could be made available in the Sacramento River.

Quantity -- Information communicated from Waikea is that potentially, from several sources, there is about 50,000 acre-feet of transferable water under their control. This amount of water has not been substantiated as effectively "new" water that could in fact be transferred. Work is underway by Waikea to make this determination.

From the most recent communications with representatives of Waikea, indications are that commitments have been obtained from other prospective buyers to purchase any water that can be made available.

Water Entitlement -- Under this concept, the water entitlement would be through a permanent transfer of the water entitlement or a water purchase agreement.

Cost -- The cost associated with the purchase of water from Waikea was indicated to range from $1,250 to $2,250 per acre-foot as a capitalized one-time cost.

Environmental -- Environmental considerations for water that would be transferred from Northern California ranches would have to be dealt with in making the supply available and would be peculiar to the specified ranch. Theoretically, this water would be an another increment to the Sacramento River, thus having a positive contribution from the location to which it enters the system to where it is diverted. Regarding the diversion, the condition applicable to the CVP and SWP supplies would apply here as well.

Viability -- The extent to which "new" water is available is not known at this time. However, according to recent communications from a representative of Waikea, commitments are being finalized for the supplies that they control.

Red Bank Project (Formerly Cottonwood Creek Project)

Concept -- The Cottonwood Creek Basin is the largest undeveloped stream tributary to the Upper Sacramento River. The basin provides an opportunity for development of a significant water supply. Water development planning studies have been conducted within the basin by the Bureau, the Corps, and DWR.

DWR completed a two-year "prefeasibility" study of the Dippingvat-Schoenfield Project, near the Red Bank Project, on South Fork Cottonwood Creek and Red Bank Creek in western Tehama County in November 1987.

The Dippingvat-Schoenfield Project would consist of two major dams and reservoirs. The major reservoirs would be connected by a conveyance system, including open channels and two small reservoirs.

The Dippingvat Dam and Reservoir would be located on the South Fork of Cottonwood Creek and would have a total storage capacity of 104,000 acre-feet. The primary function would be to provide flood control and to divert surplus winter flows to the Schoenfield reservoir.

The Schoenfield Dam and Reservoir would be located on Red Bank Creek and would have a total storage capacity of 250,000 acre-feet. The primary function would be to provide storage of the surplus winter flows from South Fork Cottonwood Creek.

Three options exist for operating the Dippingvat-Schoenfield Project to provide a supplemental water supply for Yolo and Solano counties. These options include releases into the Sacramento River, the Corning Canal, and the Tehama-Colusa Canal. Providing service to Yolo and Solano counties with water releases to the Corning Canal and the Tehama-Colusa Canal will require exchange arrangements with the Bureau for releases from other CVP facilities.

Quantity -- As part of the 1987 study, DWR determined that an incremental annual amount of 47,000 acre-feet would be made available to the State Water Project at the Harvey O. Banks Delta Pumping Plant during the historic 1928-1934 critical dry period. This yield is based upon the assumption that an improved cross-Delta transfer facility would be in operation.

From operating the Dippingvat-Schoenfield Project in conjunction with the Corning Canal system, DWR determined that an annual yield of 51,200 acre-feet (1922-1978) could be achieved. Deficiencies of up to 50 percent would occur in dry years, but that the accumulated total in any 7-year period would not exceed 100 percent.

On the basis of the results of the operation studies conducted by DWR, it was assumed that the Red Bank Project could yield an average of 50,000 acre-feet per year for use by Yolo and Solano counties.

Water Entitlement -- Water developed from the Red Bank Project would require an appropriation through the SWRCB. Depending upon how the project is operated, exchange agreements may be required with the Bureau allowing water exchanges and use of the Tehama-Colusa Canal.

Cost -- In the study by DWR in 1987, the project cost for the Dippingvat-Schoenfield Project was estimated to be $119,000,000 (July 1986 price basis). The project cost includes operation, maintenance, and replacement costs, environmental mitigation, and interest during construction. The project cost (July 1986 dollars) was allocated as follows: $77,800,000 to water supply; $33,300,000 to flood control; and $7,900,000 to recreation.

For purposes of this study, the capital cost of water supply from the project was estimated to be $90,248,000, or $1,800 per acre-foot (July 1991 price basis). The estimate is based upon an average annual yield of 50,000 acre-feet.

Environmental -- The California Department of Fish and Game developed mitigation requirements and costs for the Dippingvat-Schoenfield Project as part of DWR's study in 1987. The mitigation requirements included the construction, operation, and maintenance of a fish hatchery below Dippingvat Dam; the purchase of 5,000 acres of land as a wildlife mitigation area and the improvement of habitat within the area; and the operation and maintenance of the wildlife area. The mitigation requirements reportedly reflect a "worst case" basis because no specific information on project impacts was available.

Operation of the project such that releases are made directly into the Sacramento River could adversely affect anadromous fish in the river. Preliminary temperature studies by DWR indicate that when storage in Schoenfield Reservoir is low, it is possible that water entering the river may exceed 57°F.

The potential of creating a temperature problem in the river could be avoided if releases from Schoenfield were delivered to the Corning Canal or the Tehama-Colusa Settling Basin. Under these operations, releases to the river would not occur.

The California Department of Fish and Game (CDFG) desires that the gates of the Red Bluff Diversion Dam remain open from December through March to facilitate passage of anadromous fish. The potential may exist for the project to assist this effort if releases are delivered to the Tehama-Colusa Canal Settling Basin. Such deliveries could be used to supply demands in the Tehama-Colusa Canal in place of diverting water from the Sacramento River. This operation would require an exchange agreement with the Bureau.

Viability -- The Red Bank Project appears to be a technically viable project. A partnership agreement would be required with Tehama County. Tehama County desires to have assurances for future water supplies from the project, however, the magnitude of the supplies needed have not been determined. The State Water Contractors are continuing studies on the project at a low-level effort.

Conaway Conservancy Group

Concept -- In 1973, the owner of Conaway Ranch entered into a contract with the Bureau, which is effective until the year 2004. The contract recognizes the right of Conaway Ranch to divert a specified amount of water for agricultural purposes between April and October of each year. On the basis of historical water use on Conaway Ranch, the total

entitlement under the contract is 50,852 acre-feet. The contract allows the Bureau to reduce the specified entitlements by 25 percent during a critical water year. The contract allows the monthly diversions to vary provided that:

1. The total diversion during the period from April through October does not exceed the aggregate total supply allowed under the contract for those months.

2. The total during the period from July through September does not exceed the aggregate total supply allowed under the contract for those months.

Approval by the Bureau and the SWRCB are required to change the place and purpose of use.

Insofar as the operation of Conaway Ranch and the conjunctive use of surface water entitlements and groundwater can provide transferable water, the concept is to use water entitlements from Conaway Ranch.

Quantity -- Representatives of the Conaway Conservancy Group have indicated that through a conjunctive use program, transferable water of about 30,000 acre-feet per year is anticipated.

Water Entitlement -- The rights to use water entitlements belonging to the Conaway Conservancy Group would be the result of a negotiated contract or agreement.

Cost -- The cost associated with the transfer of water from the Conaway ranch is not known at this time.

Environmental -- Water available from Conaway Ranch would be obtained by diverting water from the Sacramento River. Such diversions will require compliance with the criteria of the CDFG for protection of fishery

resources. The concerns expressed by Yolo County regarding the use of groundwater in lieu of surface water entitlements as it may affect subsidence or water quality impacts will need to be evaluated.

Viability -- To the extent Conaway Conservancy Group has water that can be transferred for other purposes on other lands, the prospects for negotiating a water transfer or water purchase agreement appear viable.

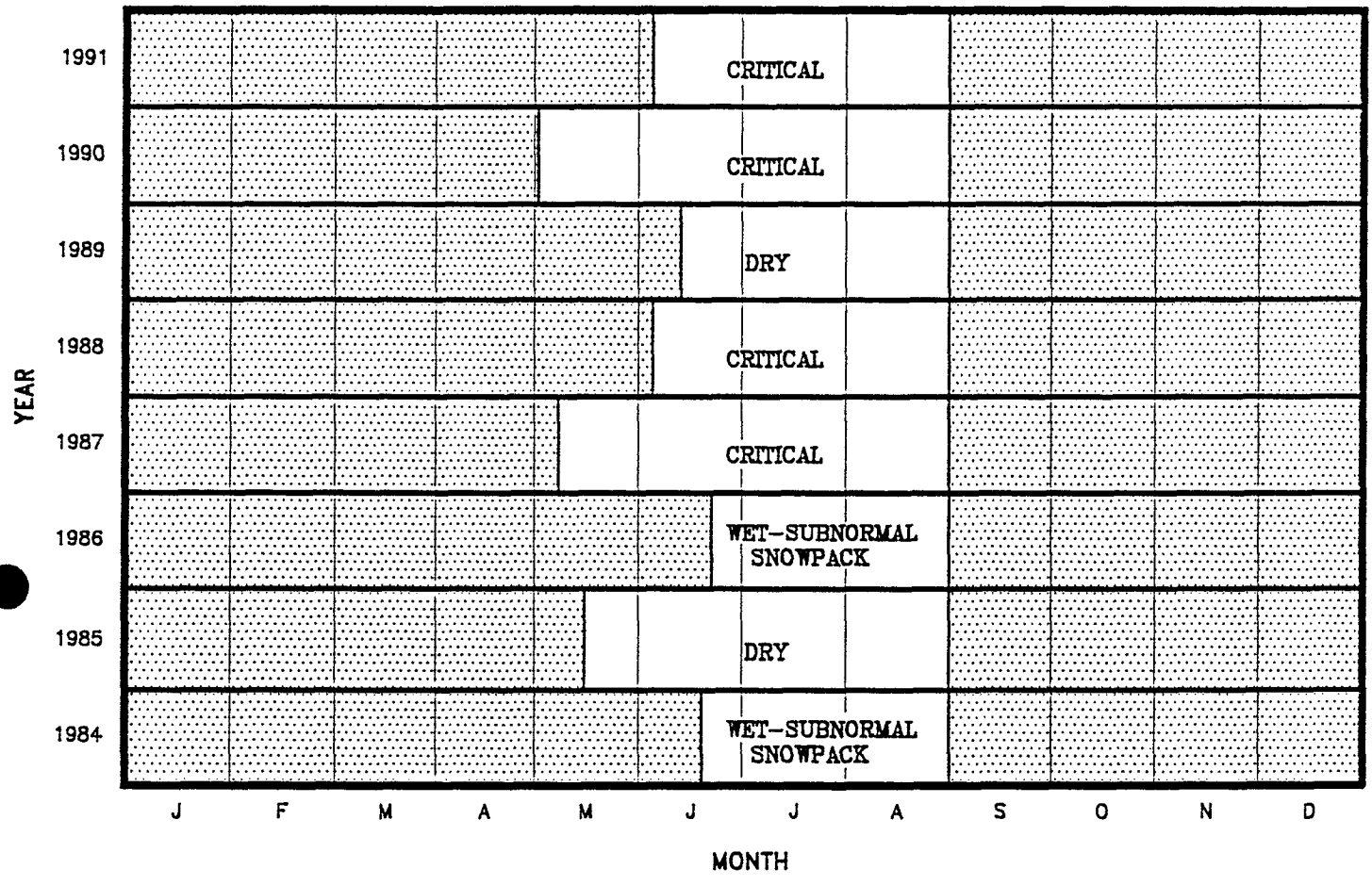
Sacramento River System

Concept -- As was indicated in material provided by the Bureau (refer to CVP discussion) the Watershed Protection Act gives water users within the watershed of origin a priority senior to rights of the Bureau or DWR, to export water from the watershed. In this regard, the concept is for an entity representing the particular agencies in Yolo and Solano counties, to appropriate water under Water Code Sections 11460-11463.

Quantity -- The quantity of water made available will depend upon the availability of water in the Sacramento River System. The determination of the availability of water for diversion from the Sacramento-San Joaquin Delta watershed is made daily. The period for which water was available for diversion during the 1984-1991 period is presented on Figure 4. Water available in the system could be diverted to meet demand directly or could be diverted to storage for use at a subsequent time. To the extent water can be diverted to storage, the appropriation of water could meet the total supplemental water demands for Yolo and Solano counties.

Water Entitlement -- As noted above, water from the Sacramento River System would be obtained through the appropriation process through the SWRCB.

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
AVAILABILITY OF WATER FOR DIVERSION (TERM 91 METHOD)
SACRAMENTO – SAN JOAQUIN DELTA WATERSHED



LEGEND

Water available for diversion

Water not available for diversion

CRITICAL Type of year

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FIGURE 4

C – 0 1 5 6 9 0

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Inspection of the information presented in Figure 4 shows that water is available for diversion from the system from the first of September through April of each year, and in some critical years even through May. On the basis of this information, a substantial part of the supplemental water demand could be met by direct diversion and virtually the entire supplemental demand could be met by appropriation if water could be diverted and stored for use in the months of June, July, and August.

Cost -- The cost associated with the appropriation of water will depend on the cost for preparing the technical and environmental analyses and documents, the fees for filing as set forth by the SWRCB, and environmental mitigation to the extent there is any.

Environmental -- The appropriation of water from the Sacramento River will be of concern from an environmental standpoint as it effects in-stream flows and mortality at the diversion. To the extent the water appropriated requires the Bureau and/or DWR to release water that otherwise would have to be held in storage, the environmental impact could be positive, since it would require an increment of additional water in the system. With respect to the diversion, it will be required to comply with the criteria established by the CDFG.

Viability -- The appropriation of a right senior to the Bureau and DWR for export of water from the Delta is a viable water supply alternative for Yolo and Solano counties. Although an application to appropriate water will receive opposition by users of water exported from the Delta, an appropriation is consistent with the intent of the Watershed Protection Act, and the protection afforded to areas of origin. The results of the proceedings underway by the SWRCB to establish new standards for the Bay-Delta Estuary could affect the availability of water supplies. The availability of water as presented in Figure 4 is based upon standards set through Decision 1485.

WATER DIVERSION/CONVEYANCE ALTERNATIVES

General

Certain alternative water supplies discussed in the previous section of this report can be diverted at more than one location. To the extent a particular location facilitates the "pooling" of water from multiple sources, it offers more flexibility and a better opportunity for meeting the full amount of supplemental water demands.

Presented in Table 3 are the locations where the various supplies could be diverted.

Water Quality Considerations

The quality of water from a particular source of supply can be affected by the location of the diversion. The three major waterways for diversion include Cache Creek, the Colusa Basin Drain, and the Sacramento River. The SWRCB has stations on each waterway that are monitored at irregular intervals as part of its Toxic Substances Monitoring Program. General remarks based upon the SWRCB's monitoring program are presented below from the standpoint of suitability for the respective uses.

Cache Creek -- Water from the Cache Creek system, e.g., surface water and groundwater, contains boron. In this regard, diverting water from the Cache Creek system directly for use in Solano County is not acceptable. Water from the Cache Creek system could be allowed to flow into the Yolo Bypass where it would become an increment of the Sacramento River/Delta system. Then, by exchange, this water could be diverted from the Sacramento River where boron contamination is not a concern.

High concentrations of mercury are found in bass from Clear Lake and Cache Creek.

TABLE 3

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALTERNATIVE WATER SUPPLIES AND LOCATIONS FOR DIVERSION

Source	Locations for Diversion					
	Cache Creek Groundwater Basin	Cache Creek Near Capay	Sacramento River at Red Bluff [1]	Tehama–Colusa Canal near Williams	Sacramento River near Woodland	Colusa Basin Drain
Cache Creek Conjunctive Use	X					
Cache Creek Blue Ridge Dam		X			X	
Cache Creek Thurston Lake and Conjunctive Use	X	X			X	
Federal Central Valley Project			X		X	X
State Water Project			X		X	X
Glenn–Colusa Irrigation District			X	X	X	X
Sacramento Valley Surface Water Rights Transfer			X		X	X
Red Bank Project			X		X	X
Conaway Conservancy Group			X		X	X
Sacramento River Water Appropriation			X		X	X

[1] Water diverted from the Sacramento River at Red Bluff would be conveyed from the existing Tehama–Colusa Canal to its terminus near Dunnigan in Yolo County.

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Colusa Basin Drain -- The Colusa Basin Drain is listed in the 1990 Water Quality Assessment as having impaired water quality. Accordingly, water diverted for municipal use from the Colusa Basin Drain would not be permitted by the SWRCB. However, it could be diverted for agricultural use.

Sacramento River -- Two long-term stations on the Sacramento River, Keswick near Redding and Hood downstream of Sacramento, are monitored as part of the SWRCB's toxic monitoring program. Until 1985, only one sample from Hood exceeded pesticide or PCB criteria. Starting in 1985, when carp were first sampled at the Hood station, chlordane, DDT, HCB, and toxaphene regularly exceeded criteria. White catfish from Hood frequently exceeded criteria for chromium and mercury. Rainbow trout collected at Keswick consistently contain some of the highest metal concentrations in California. Cadmium, chromium, copper, nickel, and zinc routinely exceed criteria. Concerning municipal supply, the City of Sacramento and the City of West Sacramento divert water from the Sacramento River and both produce good quality water.

Water Demand Schedule

The supplemental water demands presented in Table 4 are distributed by month for purposes of a comparative cost analysis. Since the supplies are to supplement existing supplies, it is assumed that the supplies are used on a uniform monthly schedule. With respect to Table 4, it is noted that the demands for the City of Davis and the City of Winters were adjusted for the final analysis, which is presented in subsequent section of this report.

Comparative Cost Analysis

There are a total of 11 basic alternatives for conveying water to agencies in Yolo and/or Solano counties.

TABLE 4

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

SUPPLEMENTAL WATER DEMAND FOR COMPARATIVE COST ANALYSIS

YOLO COUNTY

Water Use/Purveyor	Water Demand, acre-feet												
	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Municipal & Industrial													
UCD	4000	340	340	340	300	300	340	340	340	340	340	340	340
City of Davis [1] [2]	25000	2100	2100	2100	2000	2000	2100	2100	2100	2100	2100	2100	2100
City of Winters [2]	10000	840	840	840	800	800	840	840	840	840	840	840	840
City of Woodland	10000	840	840	840	800	800	840	840	840	840	840	840	840
SUBTOTAL	49000	4120	4120	4120	3900	3900	4120	4120	4120	4120	4120	4120	4120
Agricultural													
UCD	6000	0	0	0	0	0	0	1200	1200	1200	1200	1200	0
YCFCWCD	40000	0	0	0	0	0	0	8000	8000	8000	8000	8000	0
YZWD	10000	0	0	0	0	0	0	2000	2000	2000	2000	2000	0
SUBTOTAL	56000	0	0	0	0	0	0	11200	11200	11200	11200	11200	0
TOTAL	105000	4120	4120	4120	3900	3900	4120	15320	15320	15320	15320	15320	4120

SOLANO COUNTY

Water Use/Purveyor	Water Demand, acre-feet												
	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Municipal & Industrial													
SID	10000	300	0	0	0	0	0	800	2000	1900	2000	1900	1100
Fairfield	30000	900	0	0	0	0	0	2400	6000	5700	6000	5700	3300
Vacaville	15000	450	0	0	0	0	0	1200	3000	2850	3000	2850	1650
Rio Vista	0	0	0	0	0	0	0	0	0	0	0	0	0
Vallejo	5000	150	0	0	0	0	0	400	1000	950	1000	950	550
Benicia	5000	150	0	0	0	0	0	400	1000	950	1000	950	550
SCWA	5000	150	0	0	0	0	0	400	1000	950	1000	950	550
Napa County	10000	840	840	840	800	800	840	840	840	840	840	840	840
SUBTOTAL	80000	2940	840	840	800	800	840	6440	14840	14140	14840	14140	8540

SUMMARY

County	Water Demand, acre-feet												
	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
YOLO	105000	4120	4120	4120	3900	3900	4120	15320	15320	15320	15320	15320	4120
SOLANO	80000	2940	840	840	800	800	840	6440	14840	14140	14840	14140	8540
TOTAL	185000	7060	4960	4960	4700	4700	4960	21760	30160	29460	30160	29460	12660

[1] The City of Davis projects a supplemental water demand of 10,000 acre-feet in the year 2015 and 20,000 acre-feet in the year 2040.

[2] The total annual supplemental demand was reduced for the final cost analysis.

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The alternatives were configured to use the alternative water supplies to provide the full supplemental demand. Variations of Alternatives 1, 2, and 10 were made to indicate the difference in cost for the delivery of water to the City of Winters. A schematic showing the facilities' layout for each alternative is presented in Appendix A. The respective alternatives reflect known constraints in service due to water quality considerations.

To facilitate understanding of the respective alternatives, the following items are highlighted.

- The cost for delivery of water for municipal use includes the cost for storage, diversion, and conveyance of raw water to a proposed water treatment plant. No costs are included for treatment or the conveyance of treated water.

- The cost for delivery of municipal water to Solano County is based upon storage, diversion, and conveyance of raw water to Solano Irrigation District's (SID) Weyand and Vaughn canals. The delivery of water for agricultural use will make water available for municipal use by exchange for water from Lake Berryessa.

- The estimated yield of water from the Cache Creek Conjunctive Use Project has been allocated to agricultural use in the YCFCWCD and YZWD. This feature is common to all alternatives.

A brief description of the respective conveyance alternatives is presented in Table 5.

TABLE 5

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLY INVESTIGATION

DESCRIPTION OF WATER CONVEYANCE ALTERNATIVES

Alternative	Description
1	Delivery of 30,000 acre-feet of water from the Cache Creek Recharge Project to the YCFCWCD and YZWD for agricultural use. Diversion from the Sacramento River east of Woodland with: (1) a pump/pipeline delivering 39,000 acre-feet annually to a regional water treatment plant for Woodland, Davis, and UCD; and (2) a pump/pipeline/canal delivering 106,000 acre-feet annually to YCFCWCD, UCD, and SID. Delivery of 10,000 acre-feet of water annually to SID is to facilitate exchanging water from Lake Berryessa to a Winters water treatment plant by means of a pumped diversion from Putah Creek.
1A	Same as Alternative 1, except that Winters receives its water supply from the Sacramento River diversion rather than by exchange for water from Lake Berryessa.
2	Delivery of 30,000 acre-feet of water from the Cache Creek Recharge Project to the YCFCWCD and YZWD for agricultural use. Diversion from the Sacramento River at Red Bluff and using the existing Tehama-Colusa Canal to its terminus in Yolo County. Extension of the Tehama-Colusa Canal to a pumped storage/dam and reservoir on Oat Creek to store water diverted from September through April for release to meet demands during May through August. Gravity release from Oat Reservoir or Tehama-Colusa Canal directly to a canal that delivers 65,000 acre-feet annually for municipal and agricultural use in Yolo County and 80,000 acre-feet annually to SID, which includes 10,000 acre-feet to facilitate exchanging water from Lake Berryessa to a Winters water treatment plant by means of a pumped diversion from Putah Creek.
2A	Same as Alternative 2, except that Winters receives its water supply from the Sacramento River via the Tehama-Colusa Canal rather than by exchange for water from Lake Berryessa.
3	Delivery of 30,000 acre-feet from the Cache Creek Recharge Project to the YCFCWCD and YZWD for agricultural use from the Colusa Basin pumped diversion/pipeline/canal for delivery of 26,000 acre-feet annually for agricultural use in Yolo County and 80,000 acre-feet annually for agricultural use in Solano County, including 10,000 acre-feet to facilitate exchanging water from lake Berryessa to a Winters water treatment plant by means of a pumped diversion from Putah Creek.

TABLE 5
(Continued)

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLY INVESTIGATION

DESCRIPTION OF WATER CONVEYANCE ALTERNATIVES

Alternative	Description
3 (Cont'd)	It is noted that the direct diversion of water from the Colusa Basin Drain to Winters for municipal use cannot be permitted. A Sacramento River diversion/pipeline for delivery of raw water to a regional water treatment plant for Woodland, Davis, and UCD.
4	Delivery of 30,000 acre-feet from the Cache Creek Recharge Project to the YCFCWCD and YZWD. Diversion from the Sacramento River east of Woodland with: (1) a pump/pipeline for delivery of 39,000 acre-feet annually to a regional water treatment plant for Woodland, Davis, and UCD; and (2) a pump/pipeline/canal for delivery of 36,000 acre-feet annually for agricultural use by the YCFCWCD and UCD and municipal use by Winters.
5	Delivery of 30,000 acre-feet from the Cache Creek Recharge Project to the YCFCWCD and YZWD. Diversion from the Sacramento River at Red Bluff and utilizing the existing Tehama-Colusa Canal to its terminus in Yolo County. Extension of the Tehama-Colusa Canal with a canal to deliver 75,000 acre-feet annually for municipal and agricultural use in Yolo County. It is noted that a dam and reservoir at Oat Creek are not required to make deliveries for Yolo County alone.
6	Delivery of 30,000 acre-feet from the Cache Creek groundwater basin to the YCFCWCD and YZWD. Gravity/pumped diversion to canal for delivery of 75,000 acre-feet annually for municipal and agricultural use in Yolo County.
7	Diversion from the Sacramento River east of Woodland with a pump/pipeline/canal for delivery of 70,000 acre-feet annually to SID for agricultural use.
8	Diversion from the Sacramento River at Red Bluff using the existing Tehama-Colusa Canal to its terminus in Yolo County. Extension of the Tehama-Colusa Canal with a canal to deliver 70,000 acre-feet annually to SID for agricultural use. Here again, a dam and reservoir at Oat Creek is not required to make deliveries for Solano alone.
9	Pumped diversion/pipeline/canal for delivery of 70,000 acre-feet annually to SID for agricultural use. Delivery of 30,000 acre-feet from the Cache Creek Recharge Project to the YCFCWCD and YZWD.

TABLE 5
(Continued)

YOLO-SOLANO SUPPLEMENTAL WATER SUPPLY INVESTIGATION

DESCRIPTION OF WATER CONVEYANCE ALTERNATIVES

Alternative	Description
10	Diversion from the Glenn-Colusa Irrigation District using the existing Tehama-Colusa Canal to its terminus in Yolo County. Extension of the Tehama-Colusa Canal with a canal for delivery of 65,000 acre-feet annually for municipal and agricultural use in Yolo County and 80,000 acre-feet annually to SID for agricultural use, including 10,000 acre-feet to facilitate exchanging water from Lake Berryessa to a Winters water treatment plant by means of a pumped diversion from Putah Creek. It is noted that a dam and reservoir at Oat Creek is not required since deliveries from GCID to the Tehama-Colusa Canal would occur downstream of the reach of the canal which may have capacity constraints during the summer months.
10A	Same as Alternative 10, except that Winters receives its supply from diversions through GCID rather than by exchange for water from Lake Berryessa.
11	Delivery of 30,000 acre-feet from the Cache Creek Recharge Project to the YCFCWCD and YZWD for agricultural use. Diversion from the Sacramento River east of Woodland with a pump/pipeline delivering 39,000 acre-feet annually to a regional water treatment plant for Woodland, Davis, and UCD. Diversion from the GCID and using the existing Tehama-Colusa Canal to its terminus in Yolo County. Extension of the Tehama-Colusa Canal with a canal delivering 36,000 acre-feet annually for agricultural use and municipal use for Winters in Yolo County, and 70,000 acre-feet annually for agricultural use in Solano County.

Summarized on Table 6 and Table 7 are the comparative costs for the respective alternatives. Table 6 presents the total project cost[4/] and the unit cost on an acre-foot basis. The costs have been allocated to respective agencies based upon the peak diversion and conveyance capacity. Table 7 shows the comparative annual costs.[5/]

4/ Total project cost includes the estimated cost for engineering and construction.

5/ Annual cost reflects financing for 30 years at eight percent interest, power and energy costs, and operations and maintenance costs.

TABLE 6

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

COMPARATIVE COST FOR CONVEYANCE ALTERNATIVES

(July 1991 Dollars)

Alternatives	Total Project Cost $1,000	Allocation of Costs Total Cost ($1,000)/Unit Cost ($/acre-feet)						
		Solano	Winters	UCD	Davis	Woodland	YCFCWCD	YZWD
1. Yolo–Solano Water Supply Via the Sacramento River	167,851	82,652 1,181	14,301 1,430	9,190 919	15,548 622	6,176 618	33,961 849	6,023 602
1A. Yolo–Solano Water Supply Via the Sacramento River	165,969	86,311 1,233	7,450 745	9,460 946	15,548 622	6,176 618	35,001 875	6,023 602
2. Yolo–Solano Water Supply Via the Tehama–Colusa Canal	170,456	79,148 1,131	13,744 1,374	9,685 969	20,679 827	8,194 819	32,983 825	6,023 602
2A. Yolo–Solano Water Supply Via the Tehama–Colusa Canal	165,135	80,035 1,143	7,059 706	9,759 976	20,770 831	8.279 828	33,210 830	6,023 602
3. Yolo–Solano Water Supply Via the Colusa Basin Drain and Sacramento River	135,537	61,324 876	11,265 1,127	7,347 735	15,548 622	6,176 618	27,854 696	6,023 602
4. Yolo Water Supply Via the Sacramento River	102,292	NA NA	11,422 1,142	13,783 1,378	15,548 622	6,176 618	49,340 1,234	6,023 602
5. Yolo Water Supply Via the Tehama–Colusa Canal	63,069	NA NA	6,050 605	6,046 605	15,399 616	6,131 613	23,420 586	6,023 602
6. Yolo Water Supply Via the Blue Ridge Dam and Reservoir (or Thurston Lake)	48,302	NA NA	4,721 472	3,610 361	12,077 483	4,802 480	17,069 427	6,023 602
7. Solano Water Supply Via the Sacramento River	87,791	87,791 1,254	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
8. Solano Water Supply Via the Tehama–Colusa Canal	42,381	42,381 605	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
9. Solano Water Supply Via the Colusa Basin Drain	62,675	62,675 895	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
10. Yolo–Solano Water Supply Via the Glenn–Colusa Canal and Tehama–Colusa Canal	95,108	36,049 515	7,641 764	4,938 494	14,199 568	5,632 563	20,626 516	6,023 602
10A. Yolo–Solano Water Supply Via the Glenn–Colusa Canal and Tehama–Colusa Canal	90,527	35,270 504	4,374 437	4,835 484	14,055 562	5,594 559	20,376 509	6,023 602
11. Yolo–Solano Water Supply Via the Glenn–Colusa Canal, Tehama–Colusa Canal and the Sacramento River	94,612	36,504 521	4,453 445	5,181 518	15,548 622	6,176 618	20,438 511	6,023 602

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TABLE 7

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

COMPARATIVE ANNUAL COST FOR CONVEYANCE ALTERNATIVES

(July 1991 Dollars)

Alternatives	Total Project Cost $1,000	Allocation of Costs Total Cost ($1,000)/Unit Cost ($/acre-feet)						
		Solano	Winters	UCD	Davis	Woodland	YCFCWCD	YZWD
1. Yolo–Solano Water Supply Via the Sacramento River	18,843	9,136 131	1,638 164	1,061 106	1,959 78	780 78	3,665 92	604 60
1A. Yolo–Solano Water Supply Via the Sacramento River	18,547	9,413 134	971 97	1,081 108	1,959 78	780 78	3,739 93	604 60
2. Yolo–Solano Water Supply Via the Tehama–Colusa Canal	15,849	7,239 103	1,362 136	885 89	1,887 75	748 75	3,124 78	604 60
2A. Yolo–Solano Water Supply Via the Tehama–Colusa Canal	15,251	7,316 105	644 64	892 89	1,894 76	757 76	3,144 79	604 60
3. Yolo–Solano Water Supply Via the Colusa Basin Drain and Sacramento River	15,281	6,784 97	1,304 130	859 86	1,959 78	780 78	2,991 75	604 60
4. Yolo Water Supply Via the Sacramento River	11,688	NA NA	1,458 146	1,661 166	1,959 78	780 78	5,226 131	604 60
5. Yolo Water Supply Via the Tehama–Colusa Canal	5,994	NA NA	653 65	547 55	1,394 56	555 56	2,241 56	604 60
6. Yolo Water Supply Via the Blue Ridge Dam and Reservoir (or Thurston Lake)	5,053	NA NA	585 59	380 38	1,226 49	488 49	1,770 44	604 60
7. Solano Water Supply Via the Sacramento River	9,675	9,675 138	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
8. Solano Water Supply Via the Tehama–Colusa Canal	3,850	3,850 55	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
9. Solano Water Supply Via the Colusa Basin Drain	6,925	6,925 99	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
10. Yolo–Solano Water Supply Via the Glenn–Colusa Canal and Tehama–Colusa Canal	8,907	3,274 47	801 80	448 45	1,284 51	509 51	1,987 50	604 60
10A. Yolo–Solano Water Supply Via the Glenn–Colusa Canal and Tehama–Colusa Canal	8,455	3,204 46	466 47	438 44	1,272 51	506 51	1,965 49	604 60
11. Yolo–Solano Water Supply Via the Glenn–Colusa Canal, Tehama–Colusa Canal and the Sacramento River	9,663	3,316 47	474 47	558 56	1,959 78	780 78	1,972 49	604 60

5/12/92

PROJECT SELECTION

General

In selecting a project or projects, full consideration must be given to both water supply and conveyance facilities.

With respect to water supplies and referring to Figure 5, the alternative sources of water supply having the best chances of materializing include the Cache Creek Conjunctive Use Project, with or without the Thurston Lake Pumped Storage Project; the appropriation of water from the Sacramento River system; and water transfers from the Conaway Conservancy Group.

Apart from the water supply from the Cache Creek Conjunctive Use Project, the alternative water supplies could all be made available in the Sacramento River east of Woodland, and to a lesser extent with the appropriate exchanges in the Sacramento River at Red Bluff where water could be diverted to the Tehama-Colusa Canal.

Referring to Table 6 and Table 7, the alternatives with water diversions from the Sacramento River east of Woodland or at Red Bluff do not appear to be the most favorable from a cost standpoint. However, for this investigation, water supply and the relative chances of obtaining adequate supplies is deemed to be an overriding factor in the selection of a project. Giving full consideration to the potential for meeting the total supplemental demands results in selecting Alternatives 1A and 2A.

With respect to the conveyance alternatives diverting water from the Sacramento River to meet Yolo and Solano's full supplemental demand, the size of facilities is larger as a result of the delivery schedules being predicated on agricultural use. This applies primarily to the 20,000 acre-feet for agricultural use by the YCFCWD and the 70,000 acre-feet delivered to SID for agricultural use.

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
COMPARATIVE EVALUATION OF WATER SUPPLY ALTERNATIVES

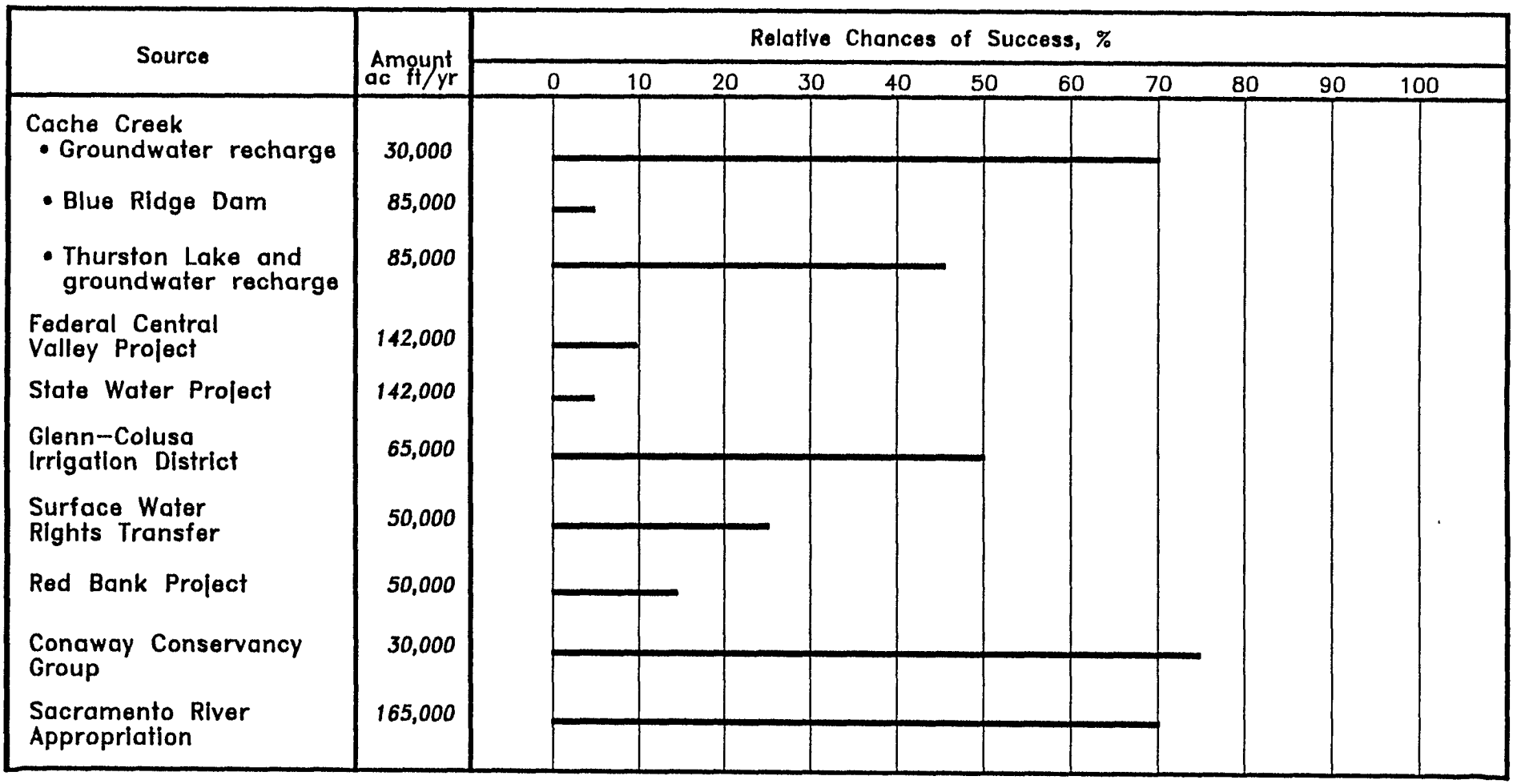

FIGURE 5

C-015704

Before proceeding with any further analyses, the significance of these factors was reviewed with the YCFCWCD and Solano County representatives. As a result of this review, the following direction was given:

1. With respect to the YCFCWCD, it was concluded that the cost of water delivered through a regional system would not be affordable. Accordingly, the District reduced its allocation at this time from 40,000 acre-feet to the 20,000 acre-feet that would be provided through the Cache Creek Conjunctive Use Project.

2. With respect to the Solano County supply, it was concluded that the sizing of facilities for delivery of 80,000 acre-feet of water per year should be based upon an M&I schedule. Henceforth, the concept is that Solano would receive water on an agricultural water use schedule until the capacity of the conveyance facilities become a constraint. At this point it is recognized that Solano would be required to construct additional facilities. This could include extension of the water conveyance facilities from SID's Weyand Canal to Solano's planned Noonan Reservoir, where it could be commingled with other supplies for distribution to urban areas, or terminal storage could be constructed to facilitate greater deliveries in the non-peak months for use in the peak summer months.

On the basis of the above noted modifications, the supplemental demands and monthly demands have been refined. The results of this refinement are presented in Table 8.

Presented in Figure 6, are the projected conveyance capacity requirements for Solano's demand based upon an agricultural and municipal schedule. As indicated, Solano would be reaching capacity constraints in about 2007.

TABLE 8

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

SUPPLEMENTAL WATER DEMAND
FINAL ANALYSIS

YOLO COUNTY

Water Use/Purveyor	Water Demand, acre-feet												
	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Municipal & Industrial													
UCD	4000	340	340	340	300	300	340	340	340	340	340	340	340
City of Davis [1]	20000	1840	1650	1650	1320	1320	1320	1650	1850	1850	1850	1850	1850
City of Winters	5000	430	430	420	380	380	380	430	430	430	430	430	430
City of Woodland	10000	840	840	840	800	800	840	840	840	840	840	840	840
SUBTOTAL	39000	3450	3260	3250	2800	2800	2880	3260	3460	3460	3460	3460	3460
Agricultural													
UCD	6000	0	0	0	0	0	0	1200	1200	1200	1200	1200	0
YCFCWCD	20000	0	0	0	0	0	0	4000	4000	4000	4000	4000	0
YZWD	10000	0	0	0	0	0	0	2000	2000	2000	2000	2000	0
SUBTOTAL	36000	0	0	0	0	0	0	7200	7200	7200	7200	7200	0
TOTAL	75000	3450	3260	3250	2800	2800	2880	10460	10660	10660	10660	10660	3460

SOLANO COUNTY

Water Use/Purveyor	Water Demand, acre-feet												
	Annual	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Agricultural	80000	2400	0	0	0	0	0	6400	16000	15200	16000	15200	8800
Municipal & Industrial	80000	7360	6600	6600	5280	5280	5280	6600	7400	7400	7400	7400	7400

[1] The City of Davis projects a supplemental water demand of 12,000 acre-feet in the year 2010 and 20,000 acre-feet in the year 2040.

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YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
PROJECTED CONVEYANCE CAPACITY

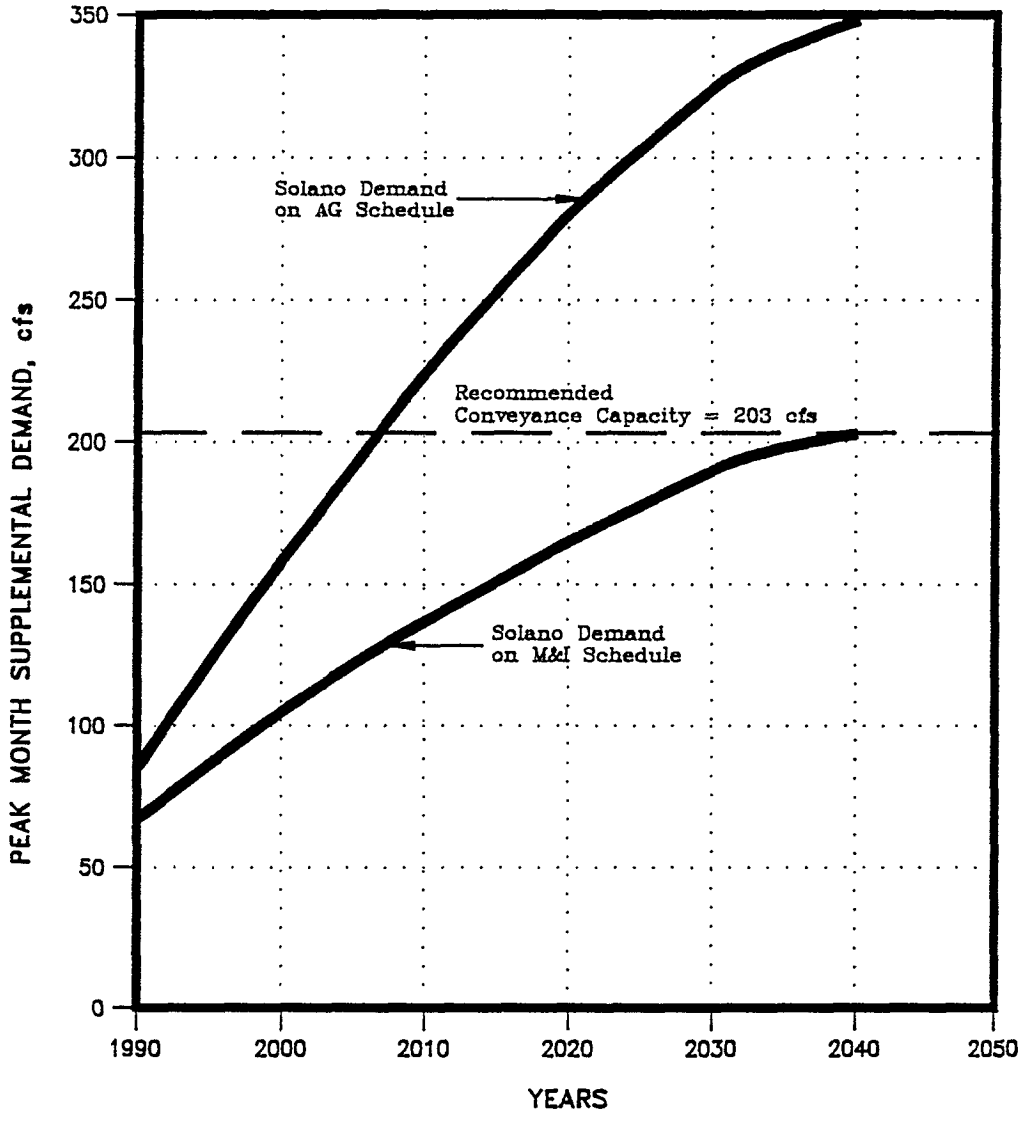

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FIGURE 6

Comparative Cost Analysis

In making a final project selection, a comparative cost analysis is performed with the projects resized to reflect the modified demands and schedule for delivery. This analysis was performed assuming that all supplemental demands except the 30,000 acre-feet from the Cache Creek Conjunctive Use Project would be available for diversion from the Sacramento River east of Woodland or at Red Bluff. The results of this analysis are presented in Table 9.

From an examination of the cost comparison presented in Table 9, a project that diverts water from the Sacramento River east of Woodland is clearly the more attractive economically. The most significant factor accounting for the difference in cost between the two projects is Oat Dam and Reservoir.

Summary

The project selected to provide the supplemental water demands for Yolo and Solano counties includes the Cache Creek Conjunctive Use Project to provide water for agricultural use by the YCFCWCD and the YZWD, and a diversion dam from the Sacramento River east of Woodland. A schematic of the selected project is presented in Figure 7.

TABLE 9

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

FINALIZED ALTERNATIVE PROJECTS COST COMPARISON

(July 1991 Dollars)

Project	Total Project Cost $1,000	Allocation of Costs Total Cost ($1,000)/Unit Cost ($/acre-feet)						
		Solano	Winters	UCD	Davis	Woodland	YCFCWCD	YZWD
Yolo–Solano Water Supply Via the Sacramento River near Woodland	152,527	77,001 963	6,137 1,227	16,664 1,664	26,404 1,320	11,928 1,193	9,613 480	4,799 480
Yolo–Solano Water Supply Via the Tehama–Colusa Canal	102,314	60,912 761	5,166 1,033	10,657[1] 1,066[2]	7,696 385	3,471 347	9,613 480	4,799 480

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[1] The total allocated cost to UCD is as Follows: Agriculture $9,249,000; M&I 1,408,000

[2] The total allocated unit cost to UCD is as Follows: Agriculture $1,542/acre-foot; M&I 352/acre-foot

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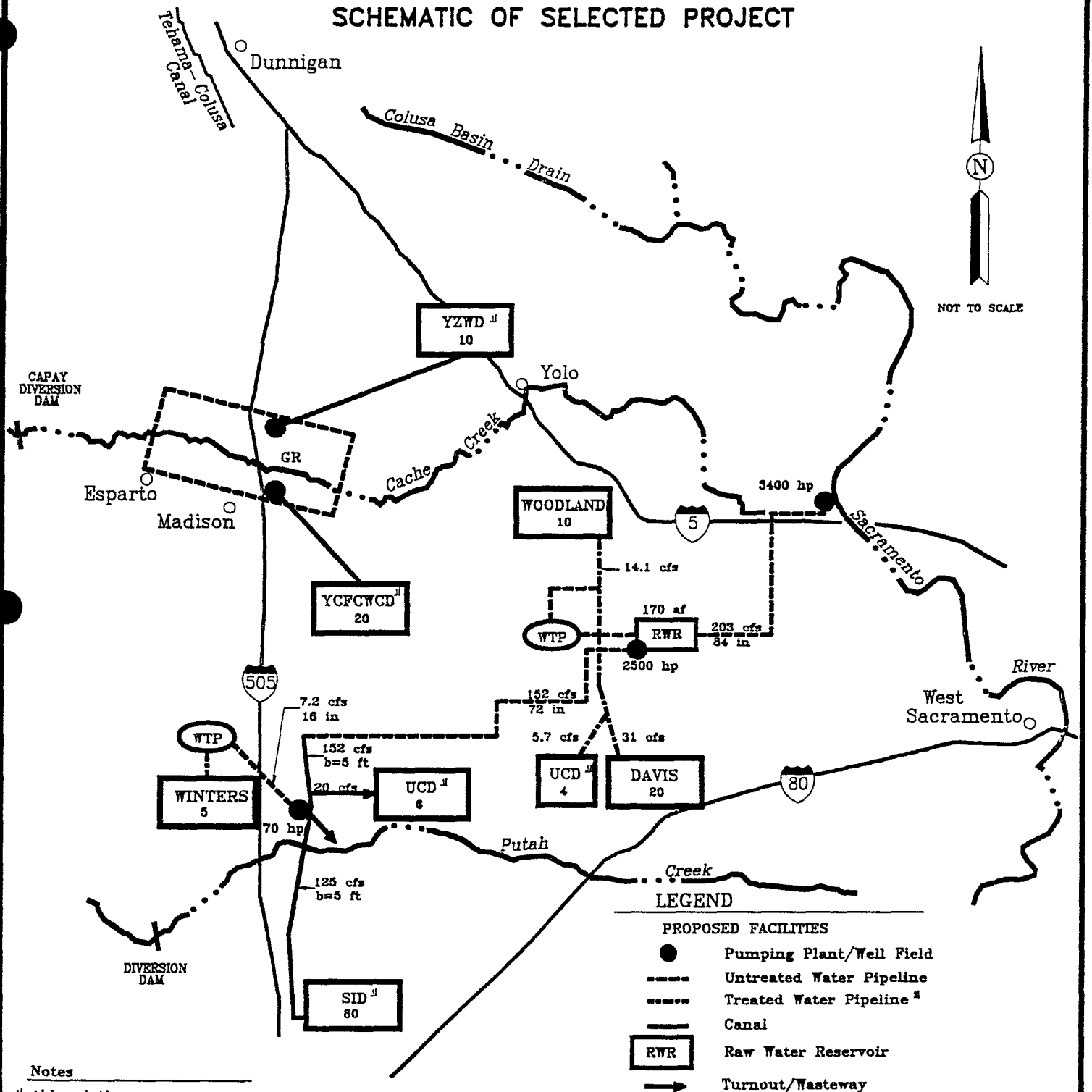
YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
SCHEMATIC OF SELECTED PROJECT



Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

[2] Facilities are shown for conceptual purposes.

PROJECT DESCRIPTION

General

Presented in this section is a description of the selected project in terms of water supply and project facilities.

Water Supply

From the results of the investigation it appears that a substantial portion of the supplemental water demands can be acquired by appropriating water and exercising the protections afforded through the Watershed Protection Act.

Water appropriated for use in the Cache Creek Conjunctive Use Project can be extracted to meet demand. Water appropriated from the Sacramento River system can, based upon the evidence from data for 1984 through 1991, be diverted to meet demand during all months except June, July, and August. Another source of water will be required to "fill in" the hole. Consideration in this regard can be given to the following:

- Purchase/transfer of Conaway Conservancy Group's entitlement
- Reuse/exchange of Woodland and Davis wastewater
- Conjunctive Water Use Program
- Thurston Lake Pumped Storage Project

To assess the prospects of being able to provide summer water, use of the Conaway entitlement is evaluated.

This evaluation is made at two points in time; 2010 and 2040. Although as shown on Figure 5, transferable water from Conaway is shown as 30,000 acre-feet, their entitlements during June, July, and August are limited. Although some flexibility exists in the monthly allocation of the entitlement, it is ignored here.

Presented in Table 10 is an assessment of the summer water supply for the two years specified. As shown, assuming the respective levels of wastewater recovery, the deficiency in the year 2010 is 3,700 acre-feet and in the year 2040 it is 8,300 acre-feet. If these deficiencies could be met through a conjunctive use program with agricultural water users near Woodland and Davis and within SID's service area, an estimate was made of the number of wells required and the amount of land that would need to participate in such a program. On the basis of this analysis, it appears that implementation of a reasonable water management program involving wastewater reuse and conjunctive use of surface and groundwater could satisfy the balance of the supplemental water demands. Also, as noted above, there is some opportunity for reallocating Conaway's monthly entitlement.

Project Facilities

Cache Creek Recharge Facilities -- The Cache Creek Conjunctive Use Project involving the reach of Cache Creek between Capay and Interstate 5, is defined preliminarily by the YCFCWCD, to include the following facilities:

1. Retrofitting the Capay Diversion Dam with an inflatable dam (to replace flashboards) three feet in height and approximately 500 feet in length to provide flexibility in diverting water from Cache Creek to enhance the opportunity for groundwater recharge.

2. Construction of Moore Dam that would employ an inflatable dam 10 feet in height and approximately 300 feet in length, and a pump station for diverting water from Cache Creek into the Moore Canal.

3. Construction of additional recharge areas.

TABLE 10

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ASSESSMENT OF SUMMER WATER SUPPLY: 2010 AND 2040

2010

Month	Conaway Entitlements ac ft	Woodland–Davis Reuse ac ft	Demand ac ft	Deficiency ac ft	Conjunctive Use Program	
					No. of Wells	Area Involved ac
June	14,690	1,500	6,500	–	–	–
July	5,374	1,500	6,500	–	–	–
August	1,258	1,500	6,500	3,742	25	3,500

2040

Month	Conaway Entitlements ac ft	Woodland–Davis Reuse ac ft	Demand ac ft	Deficiency ac ft	Conjunctive Use Program	
					No. of Wells	Area Involved ac
June	14,690	2,500	12,060	–	–	–
July	5,374	2,500	12,060	4,186	26	3,400
August	1,258	2,500	12,060	8,302	52	6,800

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4. Improvements to the East Adams and Acacia canals to facilitate water delivery to the YZWD.

5. Construction of groundwater extraction wells and making arrangements with landowners to use existing wells.

Sacramento River Diversion and Conveyance Facilities -- A schematic of the Sacramento River diversion and conveyance facilities is presented in Figure 7.

Referring to Figure 7, the principal features of the project include a pumped diversion to convey water from the Sacramento River through a Davis-Woodland pipeline to a raw water reservoir facility situated between Davis and Woodland.

The raw water reservoir would facilitate operation of the system and function as a reregulating facility to balance any mismatch in water delivery.

Water from the raw water reservoir could be pumped into a regional water treatment plant intended to service Woodland, Davis, and UCD. Also, another pumping plant would be constructed to deliver water through a Solano pipeline to a canal that would convey water to SID's Vaughn and Weyand canals. An inverted siphon would be required to cross Putah Creek. A gravity turnout would be provided to divert water to UCD's Russell Ranch and to Putah Creek if such became desirable as part of a longer term Putah Creek management program. A pumped turnout would be constructed to divert water through a Winters pipeline to a water treatment plant for the City of Winters. Summarized below is a general description of the principal features.

River Diversion -- The diversion of water from the Sacramento River is a critical feature of the project from the standpoint of operational and environmental suitability. At full development of the project, the peak diversion could be approximately 203 cfs. Various alternatives exist for making a diversion. These include:

1. Constructing an intake and pumping plant structure on the river side of the levee complete with screens for protecting fishery resources, especially juvenile salmon and striped bass. This would require relocating the levee further from the river to provide sufficient space to construct the facilities.

2. Constructing well fields on the land side of the levee and in effect pumping underflow from the river.

3. Constructing Ranney-type collectors similar to that constructed for the State of California at the intersection of S and Front streets in Sacramento. The estimated capacity of each collector is about 20 cfs, thus approximately 10 collectors would need to be phased in over time. The respective collectors would be connected by a manifold to discharge into the Davis-Woodland pipeline.

4. Constructing Ranney surface water intakes. This type of facility would be constructed on the land side of the levee and would be equipped with intake pipelines that would extend under the levees to the river. The intake pipelines would be equipped with stainless steel Johnson screens that would be designed and constructed to comply with criteria of the resource agencies. Two or three intakes of this type would be required to meet the demand at full development. Here again, the discharge from each unit would be connected by a manifold for discharge into the Davis-Woodland pipeline.

Davis-Woodland Pipeline -- The Davis-Woodland pipeline would discharge into a raw water reservoir. The pipeline would be buried the full distance and could be constructed with a mortar-lined and coated steel pipe or prestressed concrete cylinder pipe.

Raw Water Reservoir -- The raw water reservoir could be constructed to essentially balance the earthwork and could be lined to limit seepage losses. The reservoir could be sized to provide a nominal level of storage or backup capability in the event an emergency occurs and interrupts water diversion from the river.

Solano Pumping Plant/Pipeline -- A pumping plant of the raw water reservoir would discharge water into the Solano pipeline for delivery to the Solano Canal. The Solano pipeline would be buried and, similar to the Davis-Woodland pipeline, could be constructed with a mortar-lined and coated steel pipe or prestressed concrete cylinder pipe.

Solano Canal -- The Solano Canal would be a concrete-lined canal similar in construction to the Putah South Canal. Gravity turnouts would be constructed for the delivery of water to UCD's Russell Ranch, Putah Creek, and SID's Vaughn and Weyand canals. A pumping plant would be constructed to divert water from the Solano Canal through the Winters pipeline.

Winters Pipeline -- The Winters Pipeline would deliver water to a water treatment plant. The water treatment plant is not a part of this investigation. The pipeline could be constructed of steel or ductile iron.

Environmental Considerations

River Diversion Facilities -- With respect to environmental concerns, the proposed diversion of water from the Sacramento River will be the most significant factor. This concern will be twofold -- one being the

quantity of water removed from the system as it affects in-stream flows, and the other being the physical aspects of the diversion as it may be harmful to fish, particularly the chinook salmon of which there are four distinct populations or "runs" that exist in the Sacramento River. The four "runs" include the fall run, the late fall run, the winter run, and the spring run. Of the four runs, the winter run was listed as "endangered" under the California Endangered Species Act by the CDFG in August 1989. That month, the National Marine Fisheries Service proposed emergency listing of winter-run chinook salmon as "threatened" under the Federal Endangered Species Act. The official status as a threatened species came in 1990.

With respect to water diverted from the Sacramento River, that which is proposed to be diverted under an appropriation would be made consistent with the Bay-Delta standards in effect at the time. Presently the season of water availability for in-basin use is determined under Standard Water Right Term 91, which was adopted by the SWRCB on March 25, 1980. Under the Term 91 Method, water is considered available for in-basin use even at time when natural flow is insufficient to satisfy the export demand of the CVP and SWP under their direct diversion rights. The underlying assumption of the Term 91 Method is that in-basin water use is entitled to preference over CVP and SWP exports because of the watershed protection statutes. To the extent the proposed diversion requires the release of water that otherwise would be stored in CVP or SWP reservoirs, theoretically there should not be any additional reduction in flow to the Delta. Instream considerations near the diversion will require analysis. Water diverted during the months of June, July, and August is anticipated to be water transferred through a negotiated agreement with the Conaway Conservancy Group. To the extent this materializes, the diversions would be similar to those made historically.

With respect to the physical diversion of water directly from the Sacramento River, the facilities proposed will have to comply with the criteria and standards of the various resource agencies. To the extent the diversion is made through well fields or Ranney-type collectors pumping underflow from the Sacramento River, the considerations will be quite different.

Water Conveyance Facilities -- With respect to the proposed conveyance facilities, the valley elderberry longhorn beetle, a federally threatened species, is of concern where facilities would be constructed at the Sacramento River and crossing of Putah Creek.

The Swainson's hawk is of concern from the standpoint of nests or suitable perching trees along the Sacramento River, and as well as along the route of the proposed pipelines. Also, construction of the proposed raw water reservoir and construction of the regional water treatment plant, although not part of this particular project, would impact an area of high use by Swainson's hawks.

A population of Ferris bird's-beak is known to be near the proposed pipelines. The Ferris bird's-beak is designated as endangered by both the CDFG and the U. S. Fish and Wildlife Service.

PROJECT DEVELOPMENT PROGRAM

The program for development of the Yolo-Solano Supplemental Water Supply Project includes three phases: preconstruction, construction, and operations. The principal activities within each phase are presented on the Development Schedule (Figure 8). The activities presented are self-explanatory for purposes of the reconnaissance investigation; however, the following comments are made to highlight significant items that are identified for early implementation.

Participation Agreements -- Agreements are required among those agencies within each county that elect to proceed with a project. An agreement will be required to enjoin the agencies from the two counties. Important elements of the agreements include: project financing, sharing of costs, sharing/allocation of water supplies, sharing/allocation of system capacity, and management and administration of the program.

Application to Appropriate Water -- The appropriation of water is critical to the overall success in obtaining supplemental water supplies from the Sacramento River and for the Cache Creek Conjunctive Use Project. Success in obtaining a permit to appropriate water will have significant economic effects on the overall project as well. In view of the situation confronting California water and increasing competition for water, it is important that an application be filed with the SWRCB as early as possible. Bringing the water needs of Yolo and Solano counties into the equation will not be viewed favorably by existing CVP and SWP contractors. Every effort must be made to protect the watershed protection provisions of the California Water Code.

Water Purchase/Conjunctive Use Agreements -- Negotiations should be initiated with the Conaway Conservancy Group to determine how and under what conditions any transferable water can be incorporated into the proposed project in the short term while the project is being formulated and in the long term as well.

YOLO–SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
DEVELOPMENT SCHEDULE

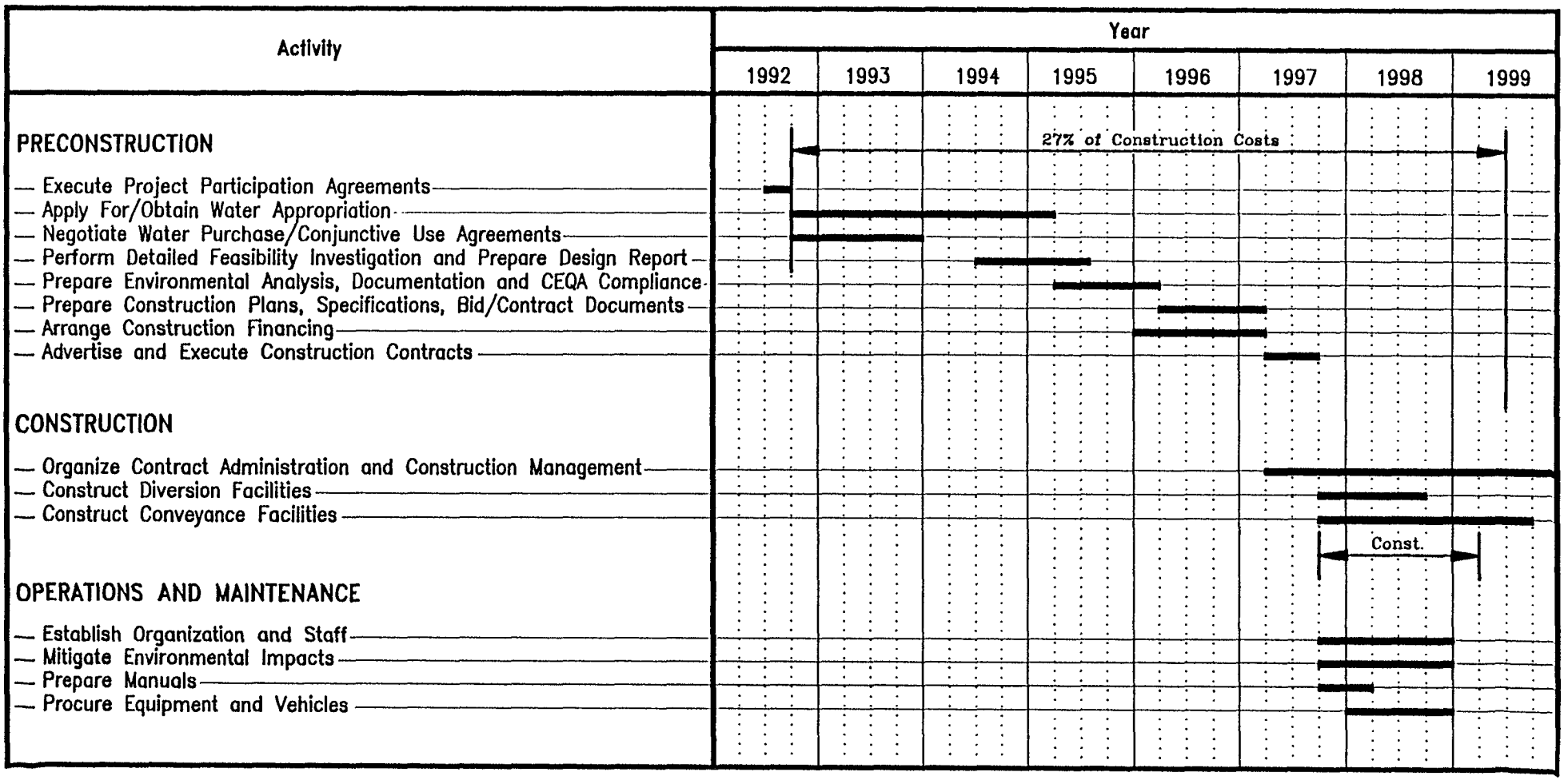

FIGURE 8

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As indicated previously, a conjunctive water use program can enable the "filling-in" of supplies during the summer months. In this regard, efforts need to be directed to determining how such a program can be configured and the lands that may be involved. With respect to Yolo County, this work could be an element of the Groundwater Management Program that is an activity identified for implementation in the county's draft Water Plan Update.

Feasibility and Environmental Analyses -- Work related to the feasibility of implementing the groundwater recharge project can be initiated at any time. However, work related to the detailed feasibility of the water diversion/conveyance project most probably would not be initiated until the process for obtaining a permit is well advanced or completed.

PROJECT COSTS

Presented in Table 11 is a breakdown of construction costs, including contingencies and costs for preconstruction engineering and environmental analyses. The allocation of costs among the respective agencies is presented on Table 11 as well. These costs have been allocated based upon the peak capacity for delivery of the supplemental supplies.

TABLE 11

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

COMPARATIVE ANNUAL COST FOR CONVEYANCE ALTERNATIVES

Item	Total Project Cost $	Allocation of Costs Total Cost ($1,000)/Unit Cost ($/acre-feet)							
		Solano	Winters	UCD-Ag	UCD-Dom	Davis	Woodland	YCFCWCD	YZWD
Sacramento River Diversion and Pumping Plant	12,523,000	7,702,000	451,000	1,240,000	351,000	1,915,000	864,000	–	–
Davis-Woodland Pipeline	37,191,000	22,873,000	1,340,000	3,681,000	1,041,000	5,690,000	2,566,000	–	–
Davis-Woodland Raw Water Reservoir	591,000	363,000	21,000	59,000	16,000	91,000	41,000	–	–
Solano Pumping Plant	5,644,000	4,628,000	265,000	751,000	–	–	–	–	–
Solano Pipeline	23,729,000	19,458,000	1,115,000	3,156,000	–	–	–	–	–
Solano Pipeline									
Reach 1	2,722,000	2,232,000	128,000	362,000	–	–	–	–	–
Reach 2	550,000	520,000	30,000	–	–	–	–	–	–
Reach 3	3,136,000	3,136,000	–	–	–	–	–	–	–
Winters Pumping Plant	895,000	–	895,000	–	–	–	–	–	–
Winters Pipeline	921,000	–	921,000	–	–	–	–	–	–
Cache Creek Conjunctive Use Project	14,412,000	–	–	–	–	–	–	9,613,000	4,799,000
Total	102,314,000	60,912,000	5,166,000	9,249,000	1,408,000	7,696,000	3,471,000	9,613,000	4,799,000

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FINANCIAL ANALYSIS

The financial analysis is performed to determine the approximate cost of supplemental water when taking into account the construction and financing costs, operations and maintenance costs, and the "buildup" time. The assumptions used in this analysis are described in the section on Basis for Analysis. The buildup in water use is based upon the information presented in the section on Supplemental Water Demands. The distribution of preconstruction and construction costs were based generally upon the Development Schedule presented in Figure 8.

On the basis of the financial analysis, the allocation of bond debt is summarized on Table 12. Presented in Table 13 is an estimate of annual costs at various times for the respective agencies.

TABLE 12
YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
ALLOCATION OF BOND DEPT

Agency	Bond Dept, $
Solano	*80,274,000*
Winters	*6,810,000*
University of California	
Agricultural	*12,190,000*
Domestic	*1,861,000*
Davis	*10,140,000*
Woodland	*4,572,000*
YCFCWCD	*12,676,000*
YZWD	*6,324,000*
Total	*134,847,000*

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TABLE 13

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ESTIMATED ANNUAL COSTS

2000
(First Year of Bond Repayment)

Item	Solano	Winters	UCD–Ag	UCD–Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	28,000	2,000	4,000	1,000	6,600	6,600	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	47.45	58.90	43.11	27.60	25.97	25.97	10.95	10.95
Bond Repayment, $/ac ft	182.51	216.75	194.00	118.50	97.82	44.09	40.35	40.26
Total Cost, $/ac ft	230	276	237	146	124	70	51	51

2014

Item	Solano	Winters	UCD–Ag	UCD–Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	57,500	3,000	5,400	2,000	12,800	10,000	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	78.02	101.16	76.52	41.85	40.92	39.49	18.44	18.44
Bond Repayment, $/ac ft	88.87	144.50	143.70	59.25	50.44	29.10	40.35	40.26
Total Cost, $/ac ft	166	245	220	101	91	68	59	59

2029
(Last Year of Bond Repayment)

Item	Solano	Winters	UCD–Ag	UCD–Dom	Davis	Woodland	YCFCWCD	YZWD
Water Demand ac ft	75,000	4,200	6,000	3,200	16,700	10,00	20,000	10,000
O&M, Insurance, Power and Energy, $/ac ft	100.02	129.26	99.10	52.12	52.05	51.38	23.82	23.82
Bond Repayment, $/ac ft	136.28	206.42	258.67	74.06	77.31	58.20	80.70	80.52
Total Cost, $/ac ft	236	336	357	126	129	110	104	104

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APPENDIX A

WATER SUPPLY/CONVEYANCE ALTERNATIVES

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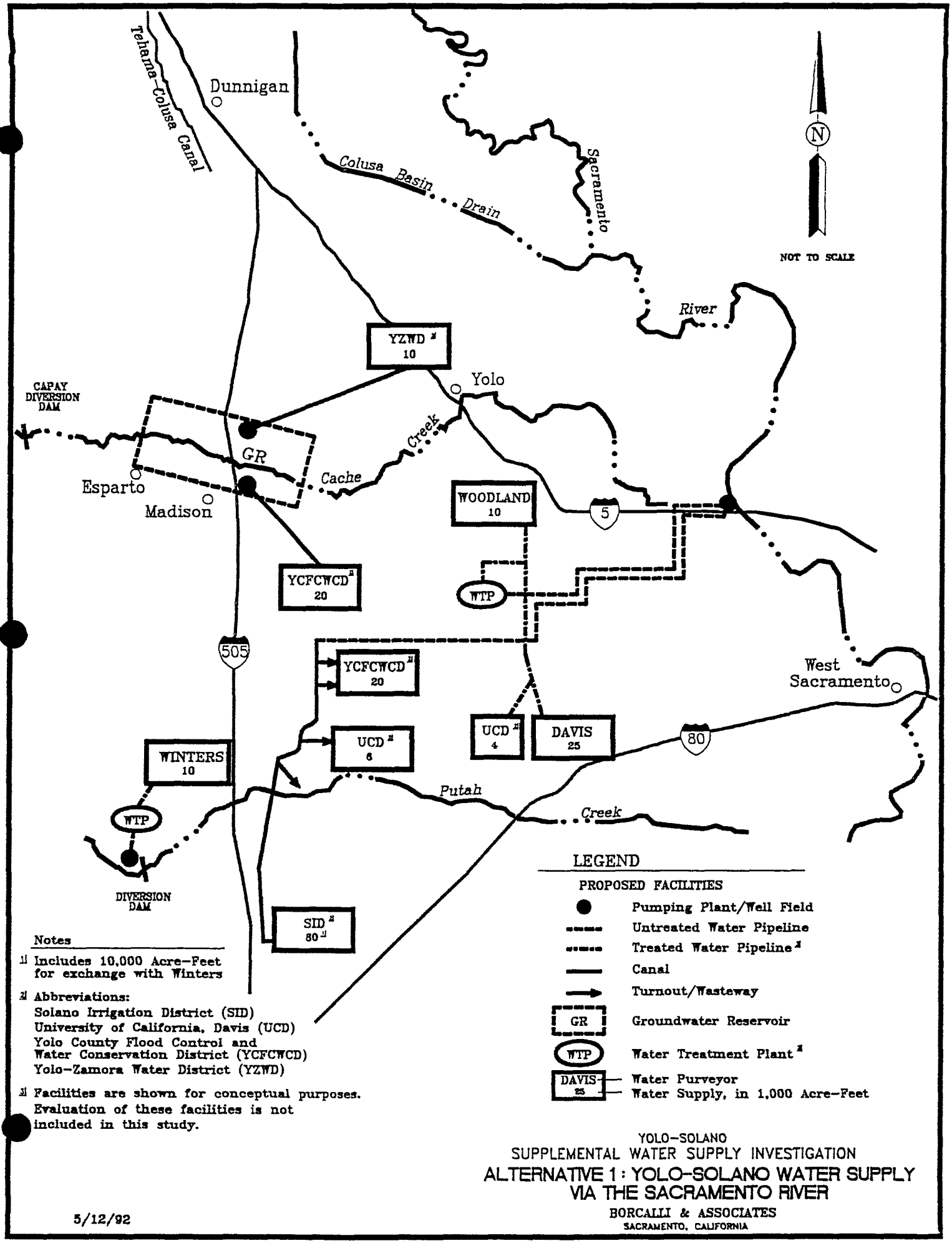

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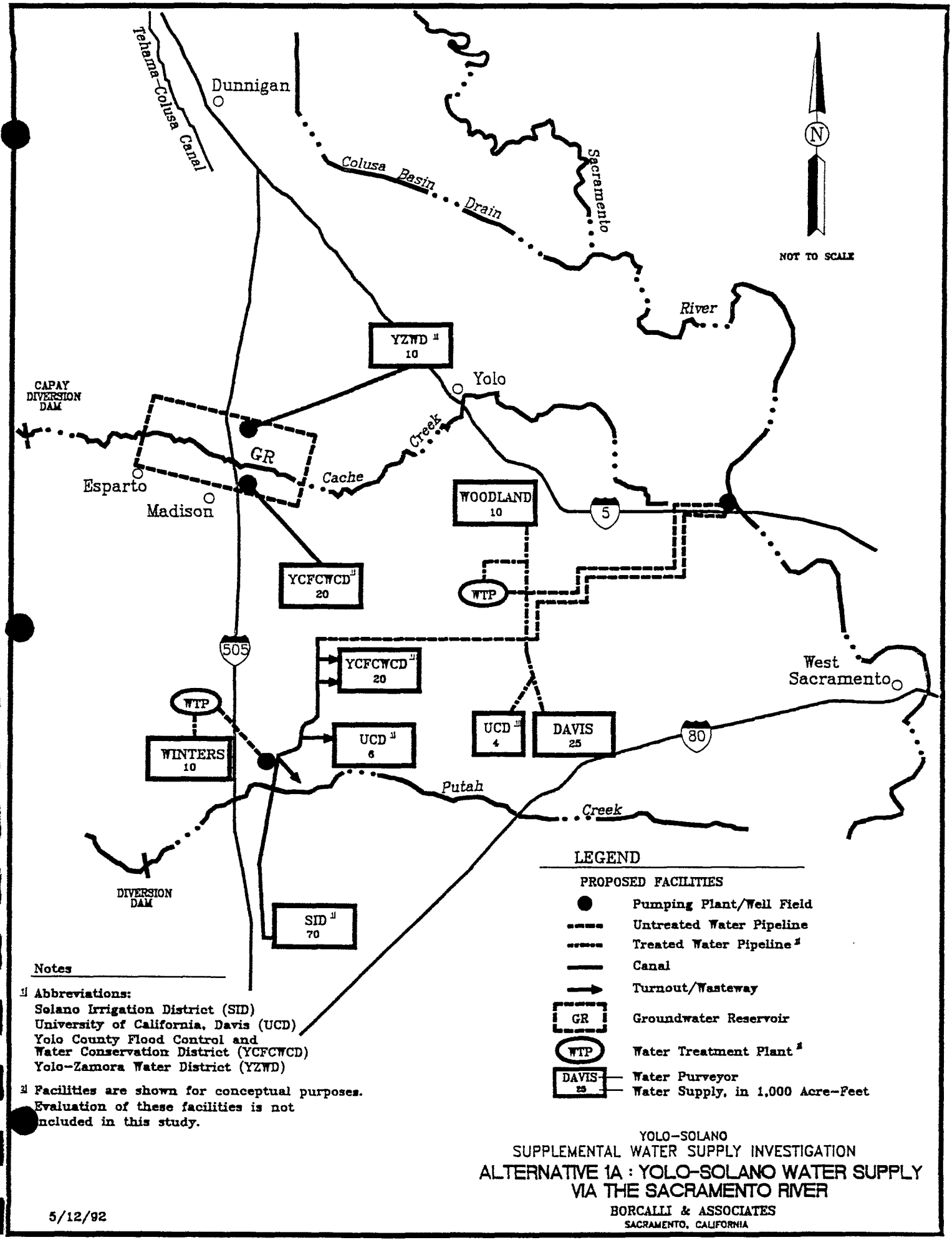

Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

[2] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

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YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALTERNATIVE 1A : YOLO-SOLANO WATER SUPPLY VIA THE SACRAMENTO RIVER

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SACRAMENTO, CALIFORNIA

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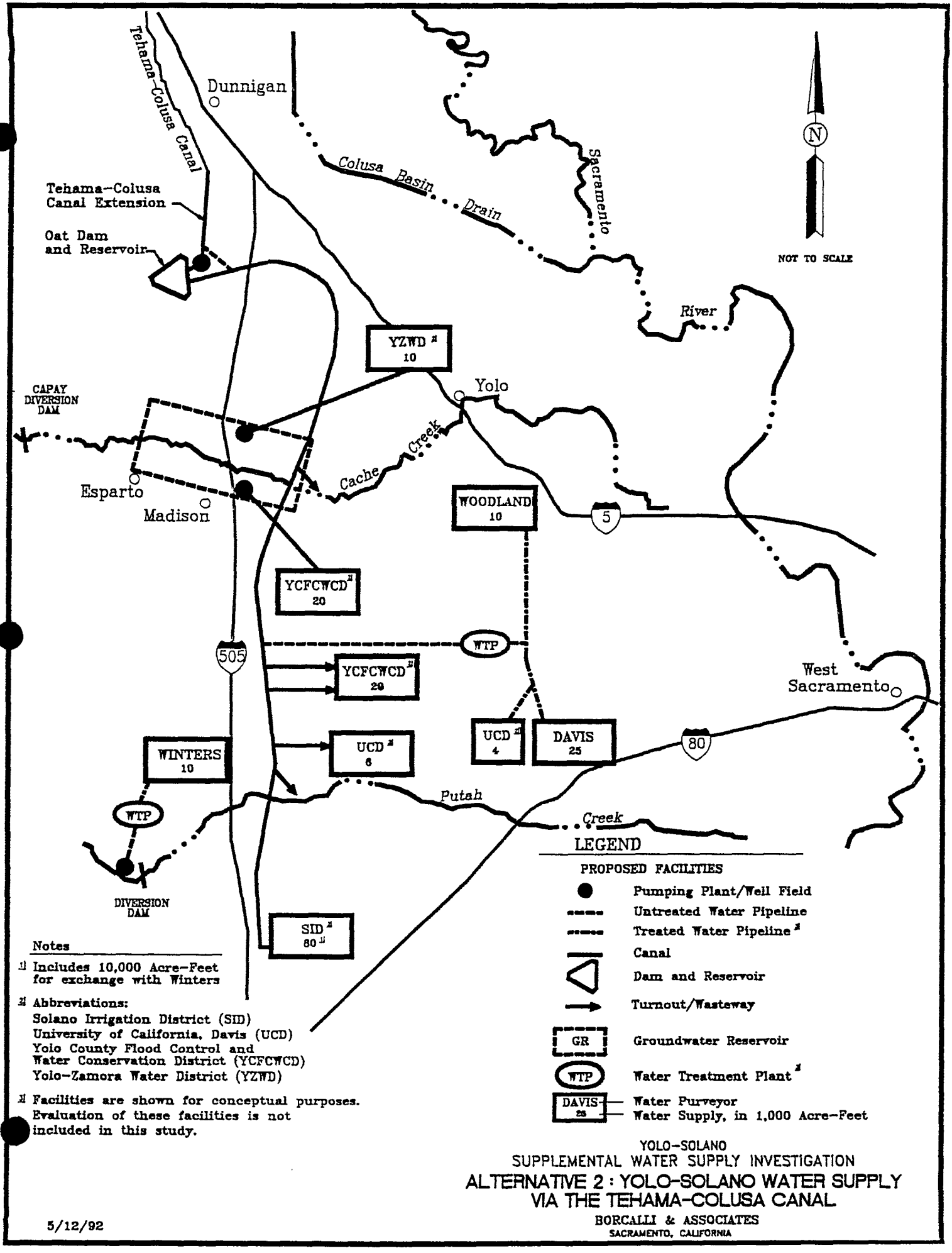

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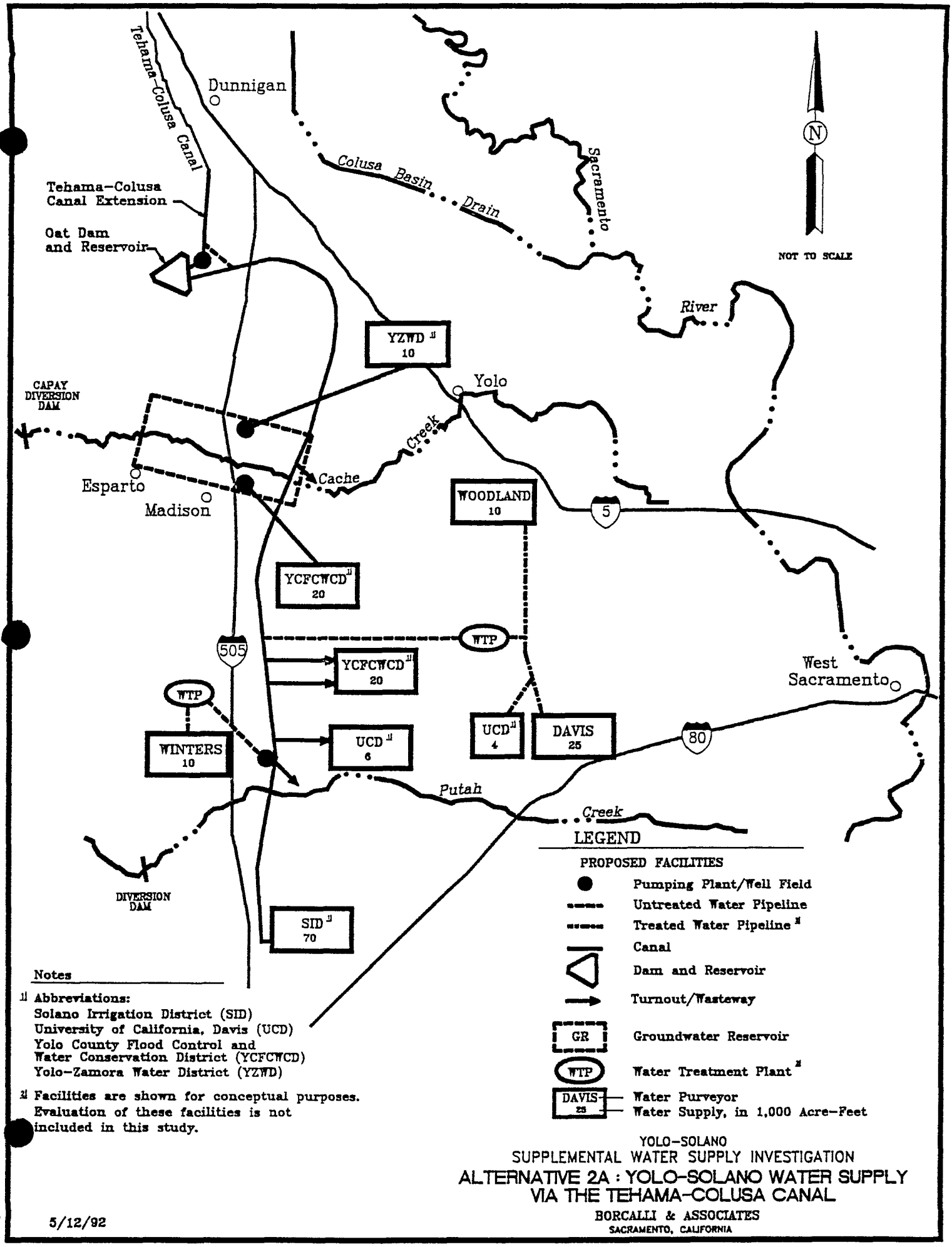

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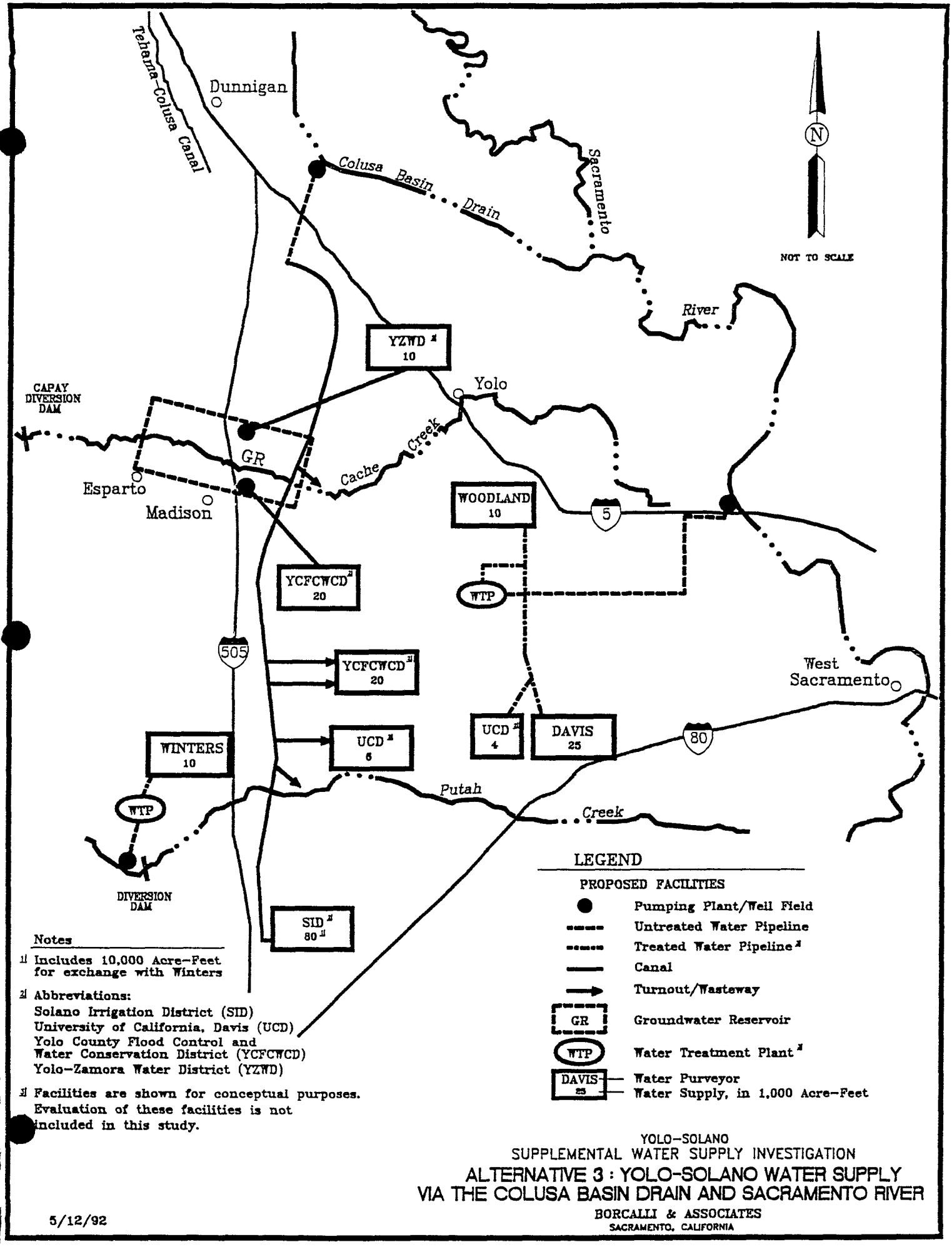

Notes

[1] Includes 10,000 Acre-Feet for exchange with Winters

[2] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

[3] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

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YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALTERNATIVE 3 : YOLO-SOLANO WATER SUPPLY VIA THE COLUSA BASIN DRAIN AND SACRAMENTO RIVER

BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

C-015732

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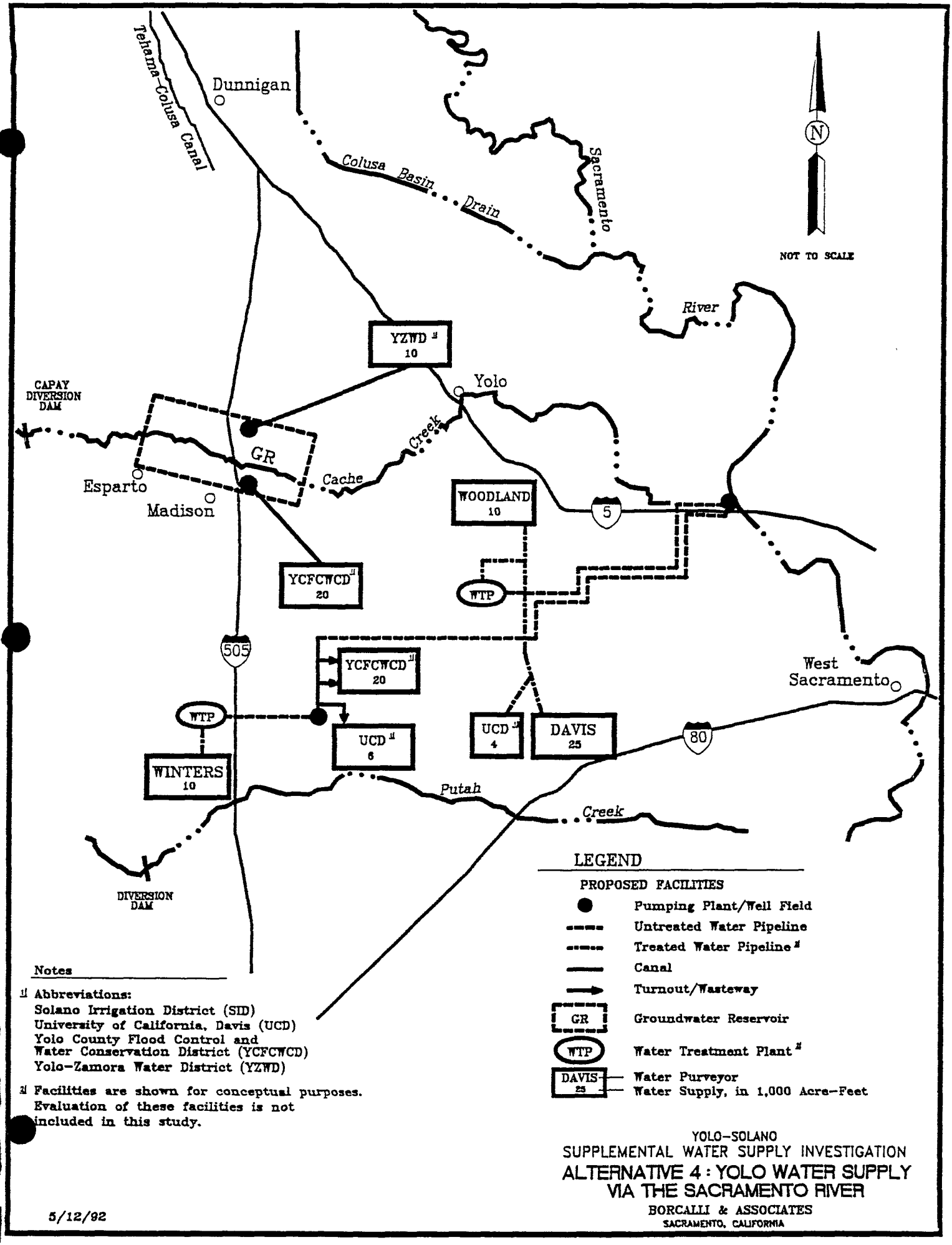


Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

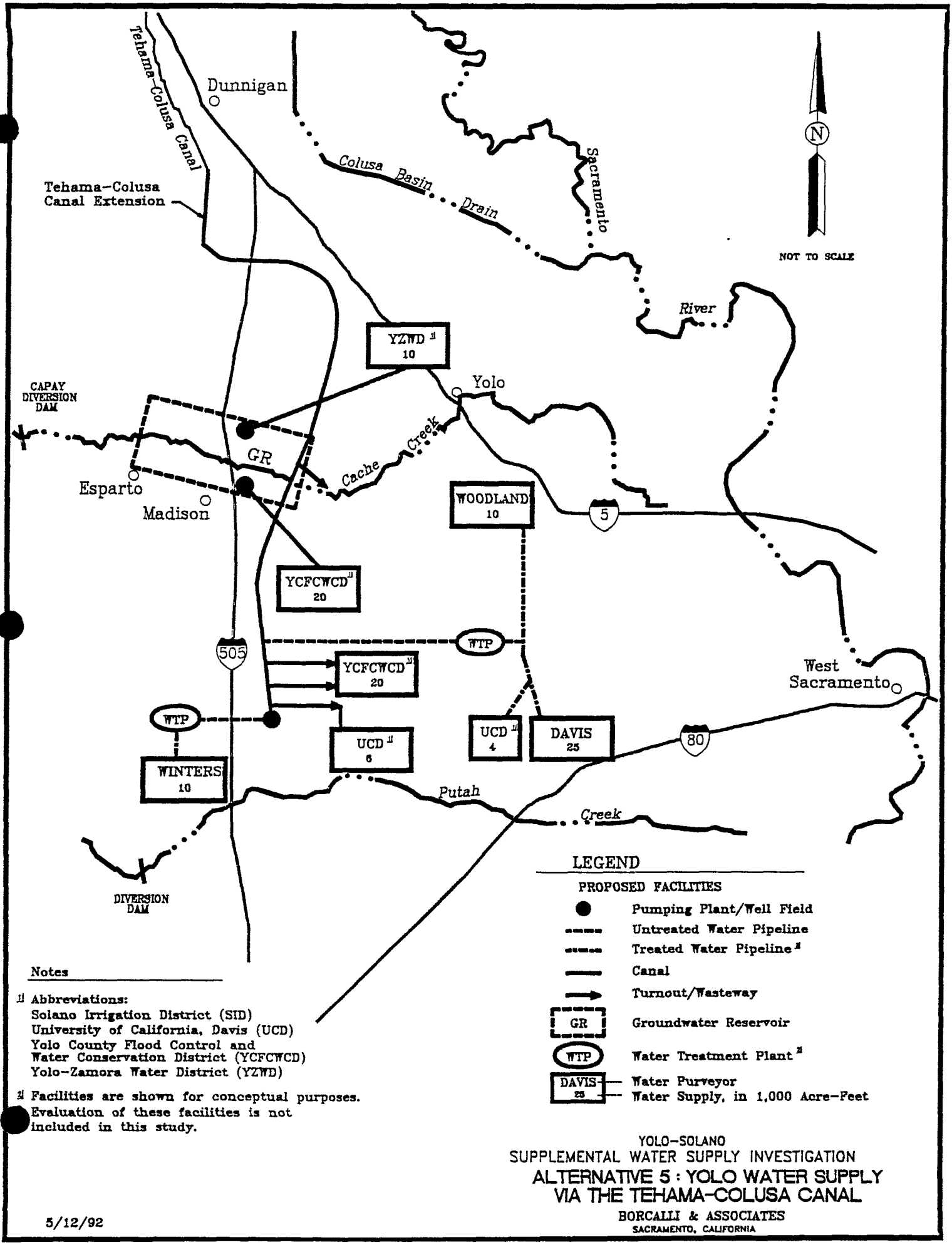
[2] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

5/12/92

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
ALTERNATIVE 4 : YOLO WATER SUPPLY VIA THE SACRAMENTO RIVER
BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

C—015733

C-015733



Notes

[1] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

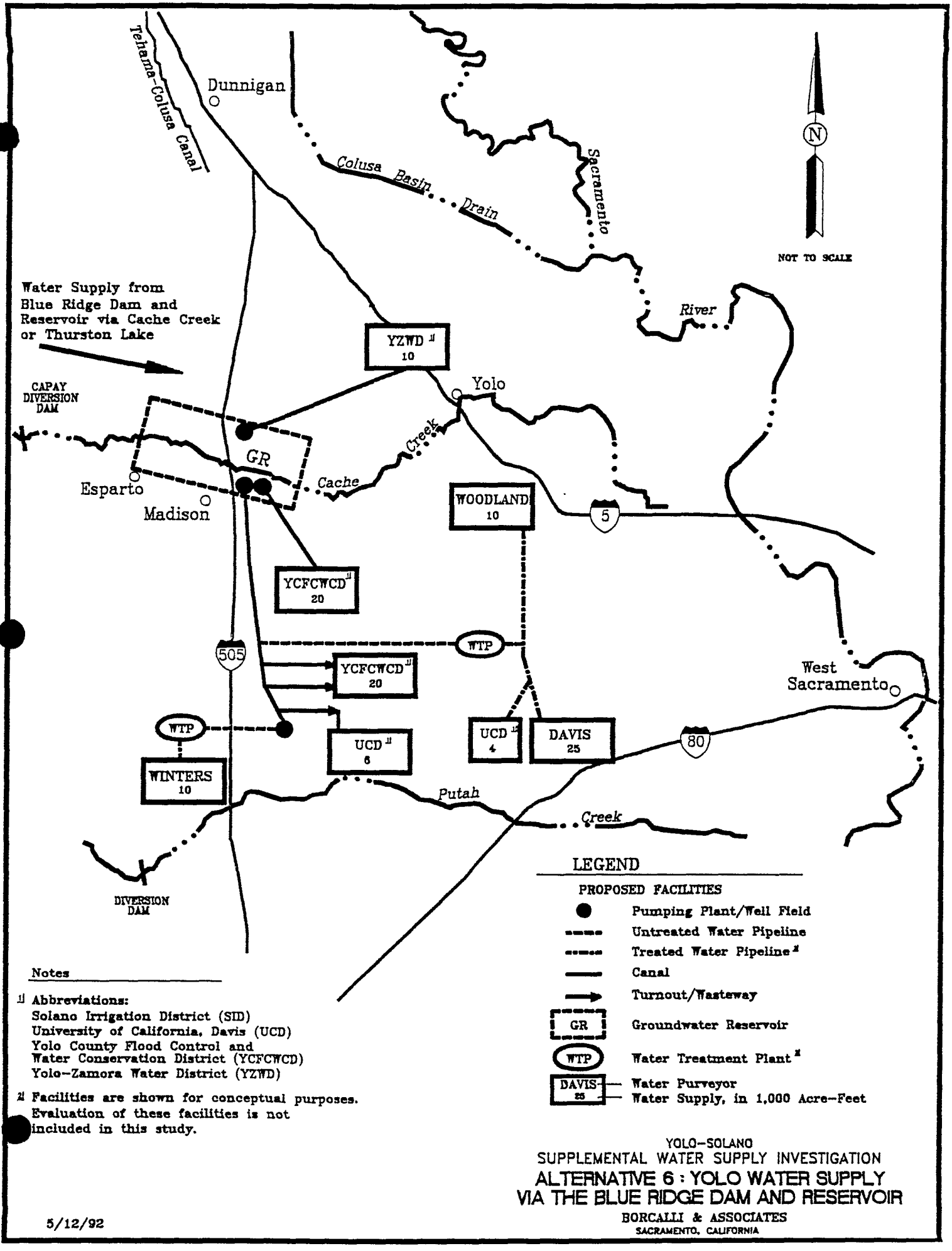
[2] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

5/12/92

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION
ALTERNATIVE 5 : YOLO WATER SUPPLY VIA THE TEHAMA-COLUSA CANAL
BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

C-015734

C-015734



C—015735

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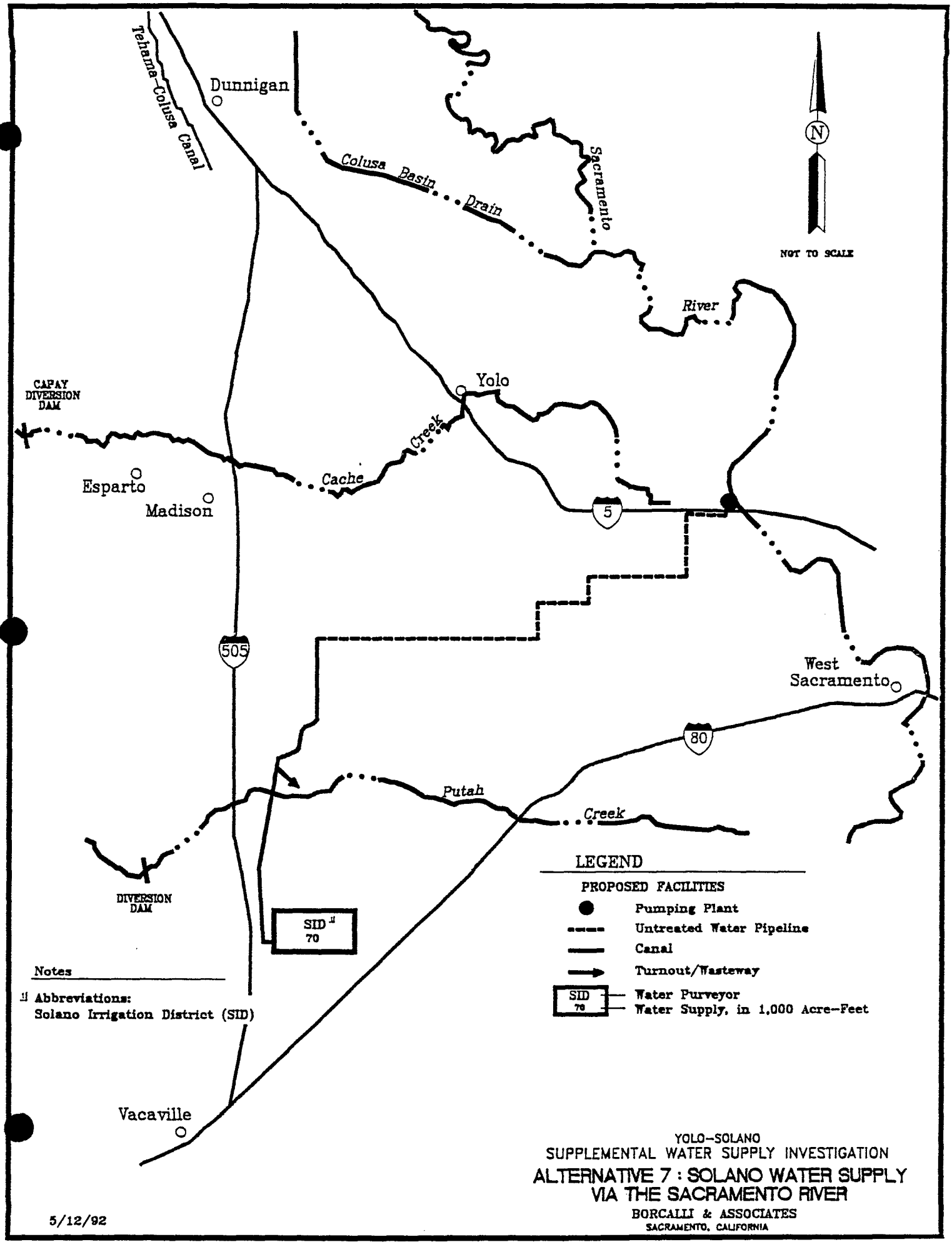

C-015736

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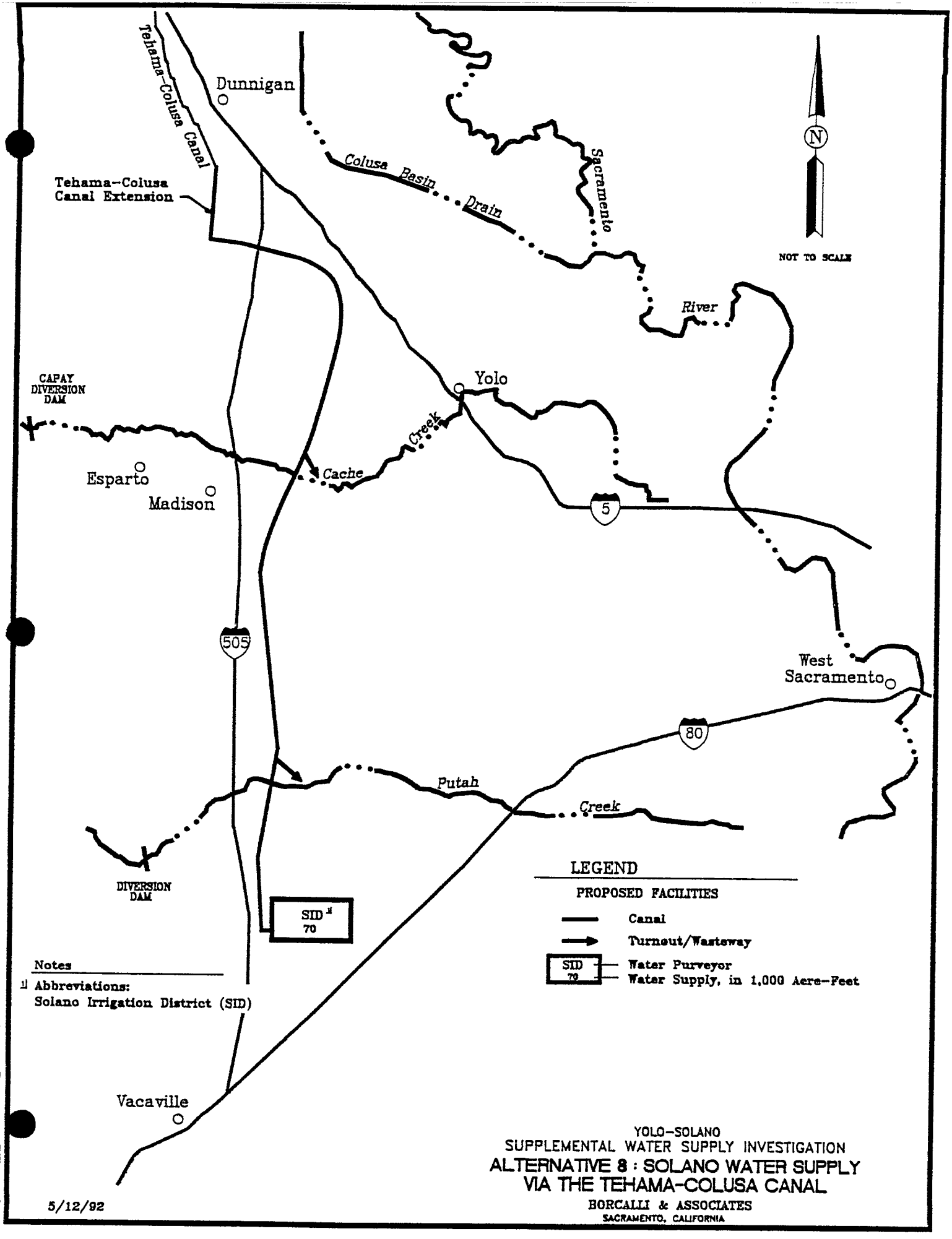

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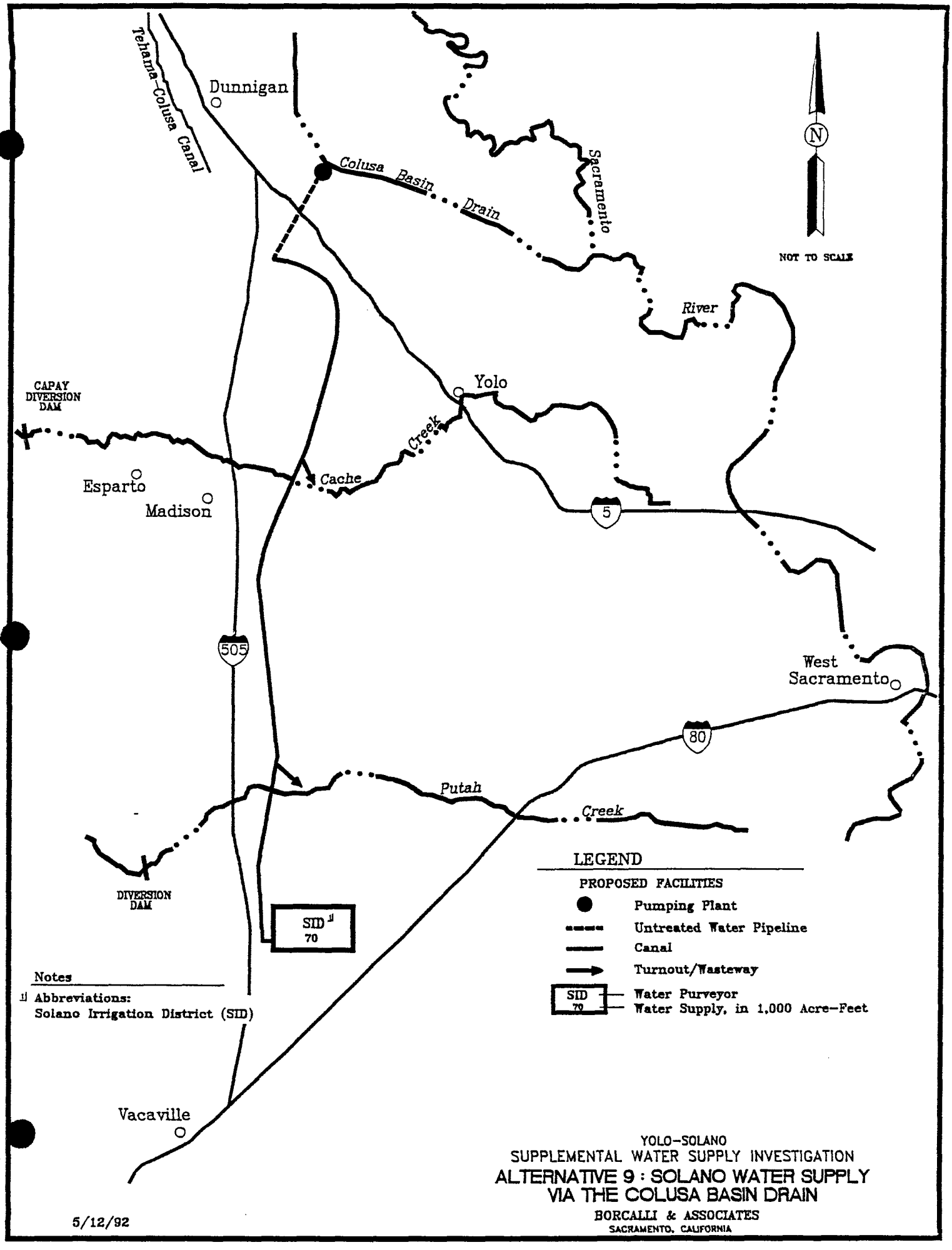

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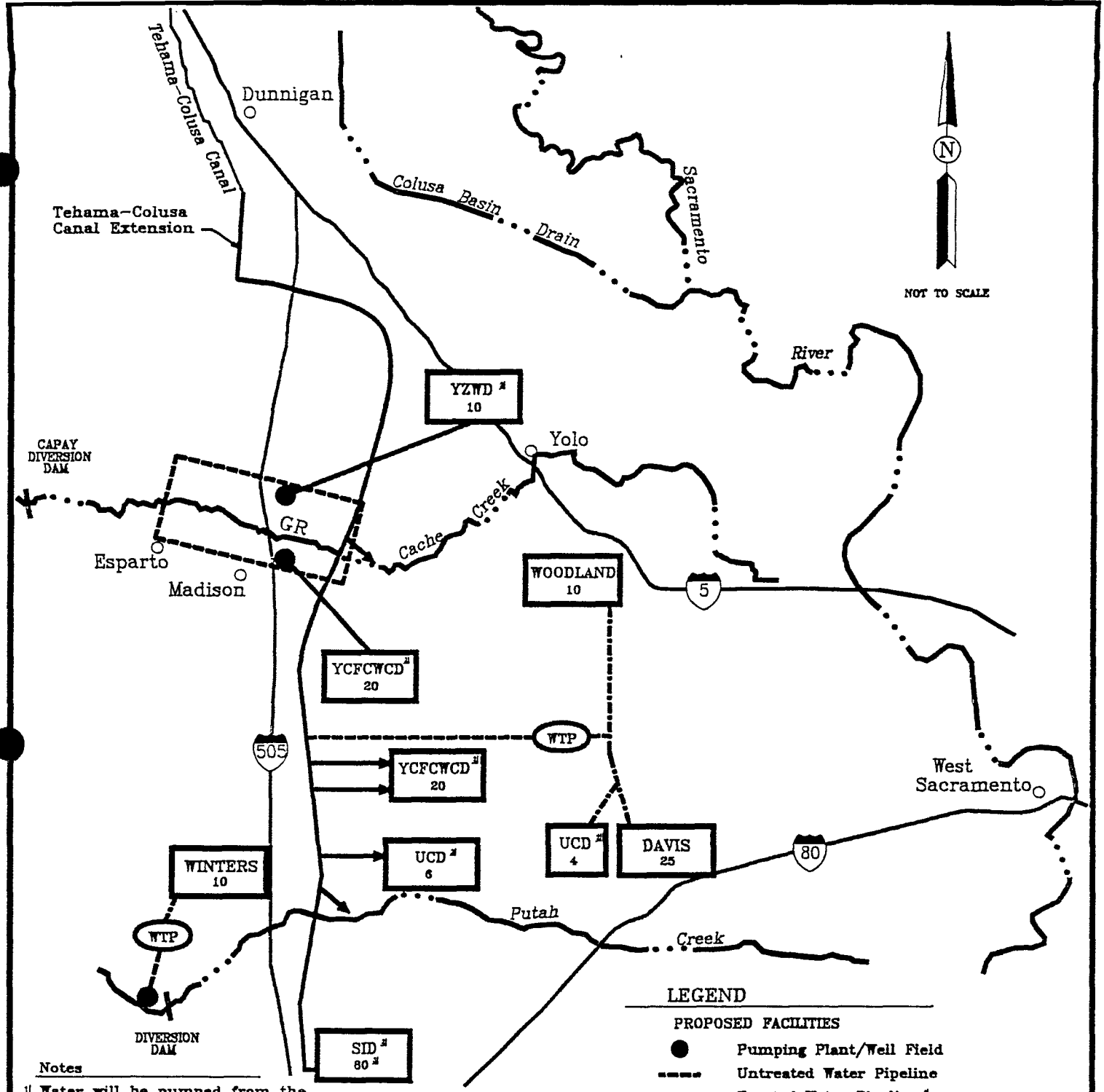


Notes

[1] Water will be pumped from the Glenn-Colusa Canal to the Tehama-Colusa Canal by the Glenn-Colusa Irrigation District.

[2] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

[3] Includes 10,000 Acre-Feet for exchange with Winters

[4] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

5/12/92

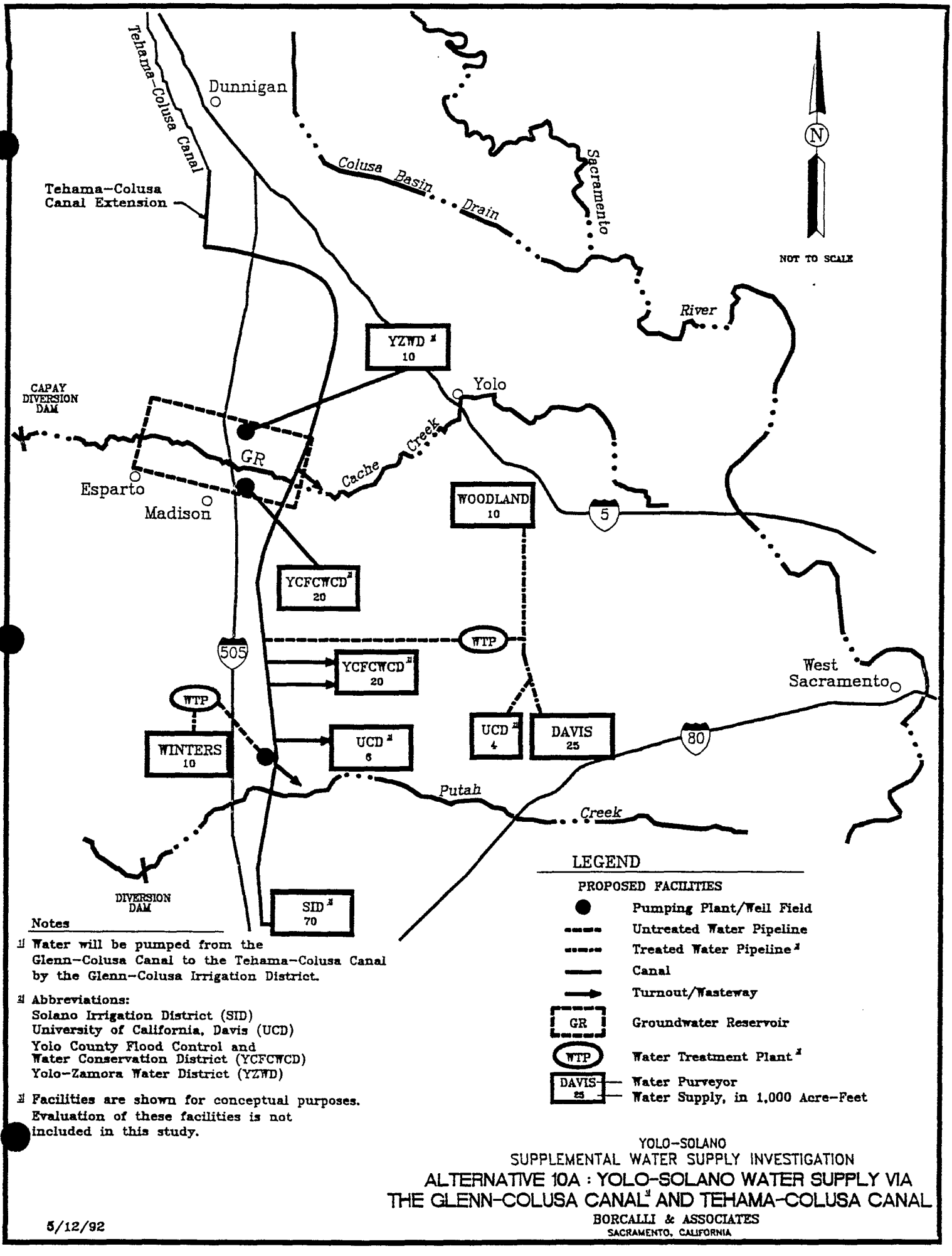
YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALTERNATIVE 10 : YOLO-SOLANO WATER SUPPLY VIA THE GLENN-COLUSA CANAL[1] AND TEHAMA-COLUSA CANAL

BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

C-015739

C-015739



Notes

[1] Water will be pumped from the Glenn-Colusa Canal to the Tehama-Colusa Canal by the Glenn-Colusa Irrigation District.

[2] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

[1] Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

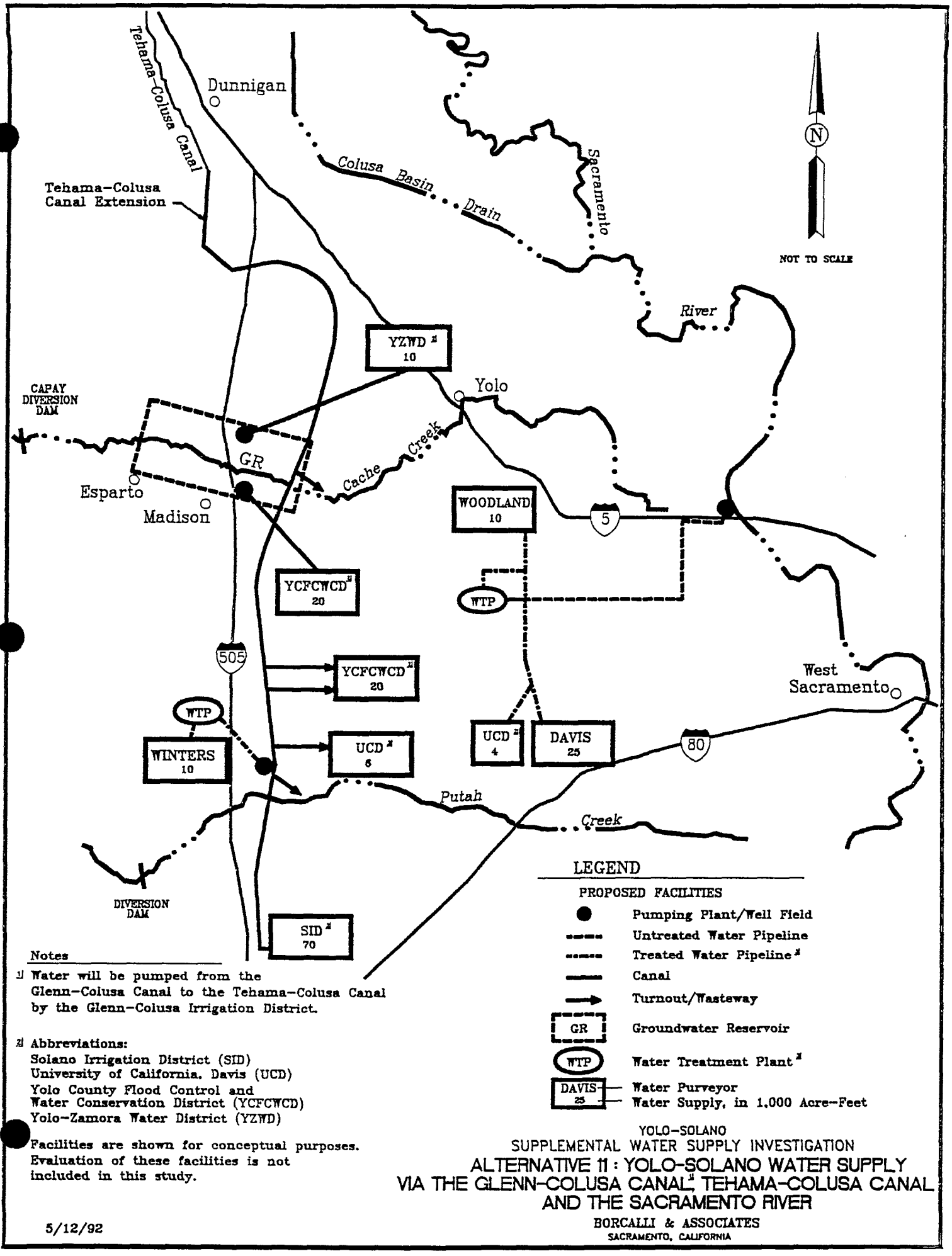
ALTERNATIVE 10A : YOLO-SOLANO WATER SUPPLY VIA THE GLENN-COLUSA CANAL[1] AND TEHAMA-COLUSA CANAL

BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

5/12/92

C-015740

C-015740



Notes

[1] Water will be pumped from the Glenn-Colusa Canal to the Tehama-Colusa Canal by the Glenn-Colusa Irrigation District.

[2] Abbreviations:
Solano Irrigation District (SID)
University of California, Davis (UCD)
Yolo County Flood Control and Water Conservation District (YCFCWCD)
Yolo-Zamora Water District (YZWD)

Facilities are shown for conceptual purposes. Evaluation of these facilities is not included in this study.

5/12/92

YOLO-SOLANO
SUPPLEMENTAL WATER SUPPLY INVESTIGATION

ALTERNATIVE 11 : YOLO-SOLANO WATER SUPPLY VIA THE GLENN-COLUSA CANAL, TEHAMA-COLUSA CANAL AND THE SACRAMENTO RIVER

BORCALLI & ASSOCIATES
SACRAMENTO, CALIFORNIA

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